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**FINAL
Expanded Site Inspection**

**Hercules Terry Creek Dredge Spoil Area
Brunswick, Glynn County, Georgia
EPA ID No. GAD982112658
WasteLAN No. 04439**

John
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WLS

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**U.S. Environmental Protection Agency
Waste Management Division
Region IV**

Prepared By
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Executive Summary

The Hercules Terry Creek Dredge Spoil Area site is located in Brunswick, Glynn County, Georgia. The Hercules Terry Creek Dredge Spoil Area is an area designated specifically for disposal of dredge spoil materials which occurs from general maintenance dredging of Terry Creek. The US Army Corps of Engineers (USACE) routinely dredged Terry Creek during the 1940s and from 1972 through 1988. Since 1938, Terry Creek's primary channel user has been Hercules, Inc., a chemical manufacturer that produced toxaphene from 1948 until its use was banned in 1980. Hercules, Inc., reportedly discharged approximately 250-300 pounds per day of toxaphene into Terry Creek prior to 1972. Hercules, Inc., then constructed a water treatment plant to control and minimize the amount of toxaphene it discharged.

In 1972, Hercules, Inc., reportedly spilled an unknown quantity of toxaphene into Terry Creek. The USACE, Savannah District, working with state and Federal officials, the City of Brunswick, and Hercules, Inc., identified and acquired a dredge disposal area to accommodate subsequent dredge spoils from Terry Creek. According to USACE, several easements within the Hercules Terry Creek Dredge Disposal Area were allocated for dredge spoil disposal. Hercules, Inc., Georgia Environmental Protection Division, and EPA entered into an agreement in 1972 or 1973, which stated that dredged material would be deposited only in a 72-acre surface impoundment designated as Area 1. However, other areas, including a 58-acre potential residential housing area and a 7-acre residential trailer park were reported to have been used as dredge disposal sites.

The Brunswick area is located in coastal Georgia, in the Sea Island section of the Atlantic Coastal Plain Physiographic Province. Topography in Glynn County consists of relatively flat land, 0 to 15 feet above mean sea level (msl), surrounded by tidal marshes, creeks, and rivers. The Hercules Terry Creek Dredge Spoil Area is bordered on the east by a tidal marsh which is periodically submerged and on the west by Dupree Creek. Two aquifer systems exist in the study area: the unconfined surficial (water table) aquifer, and the Upper Floridan Aquifer (principal artesian). Wells which utilize the water table or shallow aquifer (less than 200 feet bls) are usually privately owned wells utilized for non-agricultural irrigation systems or washing automobiles. The Upper Floridan Aquifer is the principal source of groundwater in Glynn County and is divided into two permeable zones: the upper

and lower water-bearing zones. The upper water-bearing zone includes the top 75 to 150 feet of the Ocala Limestone and contributes about 70 percent of water to wells that tap both zones. The lower water-bearing zone ranges in thickness from 15 to 110 feet and includes the Basal Ocala and the uppermost part of Middle Eocene strata. The lower water-bearing zone becomes more dense and less permeable than the upper water-bearing zone and contributes about 30 percent of water to wells that tap both zones. Water supply wells do not tap the units beneath the Upper Floridan Aquifer in Glynn County. The Upper Floridan Aquifer is a very prolific source of groundwater due to cavernous zones produced by chemical interaction of limestone with groundwater.

The Hercules Terry Creek Dredge Disposal Area was evaluated by determining if a release of hazardous substances occurred or may occur, by determining the pathways by which contamination could migrate from the site, and by determining the populations and environments contamination would potentially affect. To characterize contamination at the site, an initial sampling investigation was conducted that included the collection of 10 subsurface soil and 12 surface soil samples. Groundwater was collected from two private wells and one community well. Twelve sediment, 12 surface water, and 5 wetland sediment samples were collected to determine if contaminants were migrating from the site into the surface water pathway. An addendum field investigation was conducted in order to determine if toxaphene contamination was present in soils at two residential areas. Twenty four surface and 10 subsurface soil samples were collected during this field investigation. The combined analytical results of both field investigations indicated that onsite soils, sediment, and wetland sediment samples contained elevated levels of toxaphene.

The groundwater migration pathway is of limited concern due to a lack of evidence that indicates toxaphene has migrated into water bearing units beneath the site and the relatively low number of targets located within a 4-mile radius of the site. Potable water within the 4-mile radius of the site is supplied by the City of Brunswick Water Department and community and private wells. The Brunswick Water Department provides potable water to approximately 12,260 persons within four miles of the site through four wells completed in the Upper Floridan aquifer. Private wells located within a 4-mile radius of the site are estimated to provide drinking water to an estimated 1,542 people.

The surface water migration pathway is of primary concern. Elevated levels of

toxaphene have been detected in Dupree Creek, Terry Creek, and the Back River, all of which are recreational fisheries and known habitats for several Federally-endangered and/or threatened species. The surface water pathway includes designated recreational areas and a commercial fishery.

The soil exposure pathway is of concern because Terry Creek Trailer Park and a residential housing development are located on two suspected dredge spoil disposal areas. Elevated levels of toxaphene have been detected in soil samples collected from these areas. Airborne contamination could be of concern at this site because of the residential population and the site accessibility. However, vegetation covers the dredge spoil areas and the population of the surrounding area is relatively sparse. There are approximately 27,541 people residing within four miles of the Hercules Terry Creek Dredge Spoil Area, 4,079 of which reside within one mile. The nearest residence is located on a source. Several thousand acres of wetlands are estimated to occur within a 4-mile radius of the site.

The major migration pathway of concern at this site is the surface water pathway. Toxaphene was detected at elevated concentrations when compared to background levels in sediment samples and in wetland sediment samples from Dupree Creek, Terry Creek, and the Back River, which are known fisheries and habitats for several federally-endangered and/or threatened species. The soil exposure pathway is also of concern due to residential areas located on contaminated soil. The groundwater and air migration pathways are of limited concern.

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1.0 Introduction

Black & Veatch Special Projects Corp. (Black & Veatch) was tasked by the United States Environmental Protection Agency (EPA), Waste Management Division, Region IV to conduct an Expanded Site Inspection (ESI) at the Hercules Terry Creek Dredge Spoil Area (the site) in Brunswick, Glynn County, Georgia. The investigation was performed under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The task was performed to satisfy the requirements stated in Work Assignment No. 14 under EPA Contract No. 68-W9-0055. The field investigations were conducted during the weeks of September 19, 1995 and February 28, 1996.

1.1 Objectives

The objectives of this investigation were to determine if a release of hazardous substances has occurred or may occur. Furthermore, this ESI sought to determine the possible pathways by which contamination could migrate from the site and the populations and environments it would potentially affect.

1.2 Scope of Work

The objectives were achieved through the completion of a number of specific tasks. These tasks included the following:

- Obtain and review relevant background materials;
- Obtain information on local water systems;
- Determine the location of and distance to the nearest potable well;
- Evaluate potentially affected populations and environments associated with the groundwater migration, surface water migration, air migration, and soil exposure pathways;
- Develop a site sketch to scale;
- Record Global Positioning System (GPS) latitude and longitude coordinates at the sampling locations;

- Collect environmental samples;
- Screen dry soil matrix samples for toxaphene; and
- Develop a site-specific preliminary Hazard Ranking System (HRS) score based on data obtained.

2.0 Site Background Information

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2.1 Location

The Hercules Terry Creek Dredge Spoil Area site is located approximately 0.5 mile northeast of the intersection of U.S. Highway 17 and the Torras Causeway in Brunswick, Georgia. The geographical coordinates of Area 1 are 31° 10' 00" North latitude and 81° 28' 09" East longitude (Ref. 1). The site elevation ranges between mean sea level and approximately 10 feet above mean sea level (msl) (Ref. 1). A site location map is presented as Figure 1.

The climate of Glynn County is characterized by hot, humid summers and cool winters with occasional brief cold spells (Ref. 2, p. 1). The average annual precipitation is 52 inches (Ref. 3, p. 43). Mean annual lake pan evaporation is approximately 45 inches, yielding a net annual rainfall of 7 inches (Ref. 3, p. 63). The 2-year, 24-hour rainfall is approximately 5 inches (Ref. 4, p. 95).

2.2 Site Description

The site comprises three areas, Dredge Spoil Area 1 (Area 1), Dredge Spoil Area 2 (Area 2), and Dredge Spoil Area 3 (Area 3), all of which are situated on coastal estuarine marshlands. Terry Creek forms the southern boundary of Area 1 and Dupree Creek forms the western boundary. Area 2 is adjacent to a residential housing development, approximately 1,600 feet east of Area 1. Area 3 is located within a residential area directly south of Area 1 and Terry Creek. Nine trailers and four houses are presently located on Area 3 (Refs. 1; 5, Vol. 1, pp. 1, 1a, 8, and 23; 6, pp. 1, 2, 7, and attached map; 7, p. 3). A site layout map is presented in Figure 2.

2.3 Operational History and Waste Characteristics

2.3.1 Operational History

The Hercules Terry Creek Dredge Spoil Area consists of three tracts of marsh land designated specifically for disposal of dredge materials which occurs from general maintenance dredging of Terry Creek. These dredging activities have been referred to as the Terry Creek Project. The Terry Creek Project was authorized under the River and Harbor Act of 1938 (House Document 690) and completed in 1939, for construction of a channel 10 feet deep, 80 feet wide and 1.4 miles long (Ref. 6, p. 1).

CAD DWG NO: SITELOC
 DATE: 07-28-95 G8
 PLOT SCALE: 1=1

ORIGINAL DWG SIZE
 11 x 8.5



NOT TO SCALE

CONTOUR INTERVAL 1.5 METER

BASE MAP IS A PORTION OF THE USGS 7.5 MINUTE QUADRANGLE, BRUNSWICK EAST, GA. 1988.



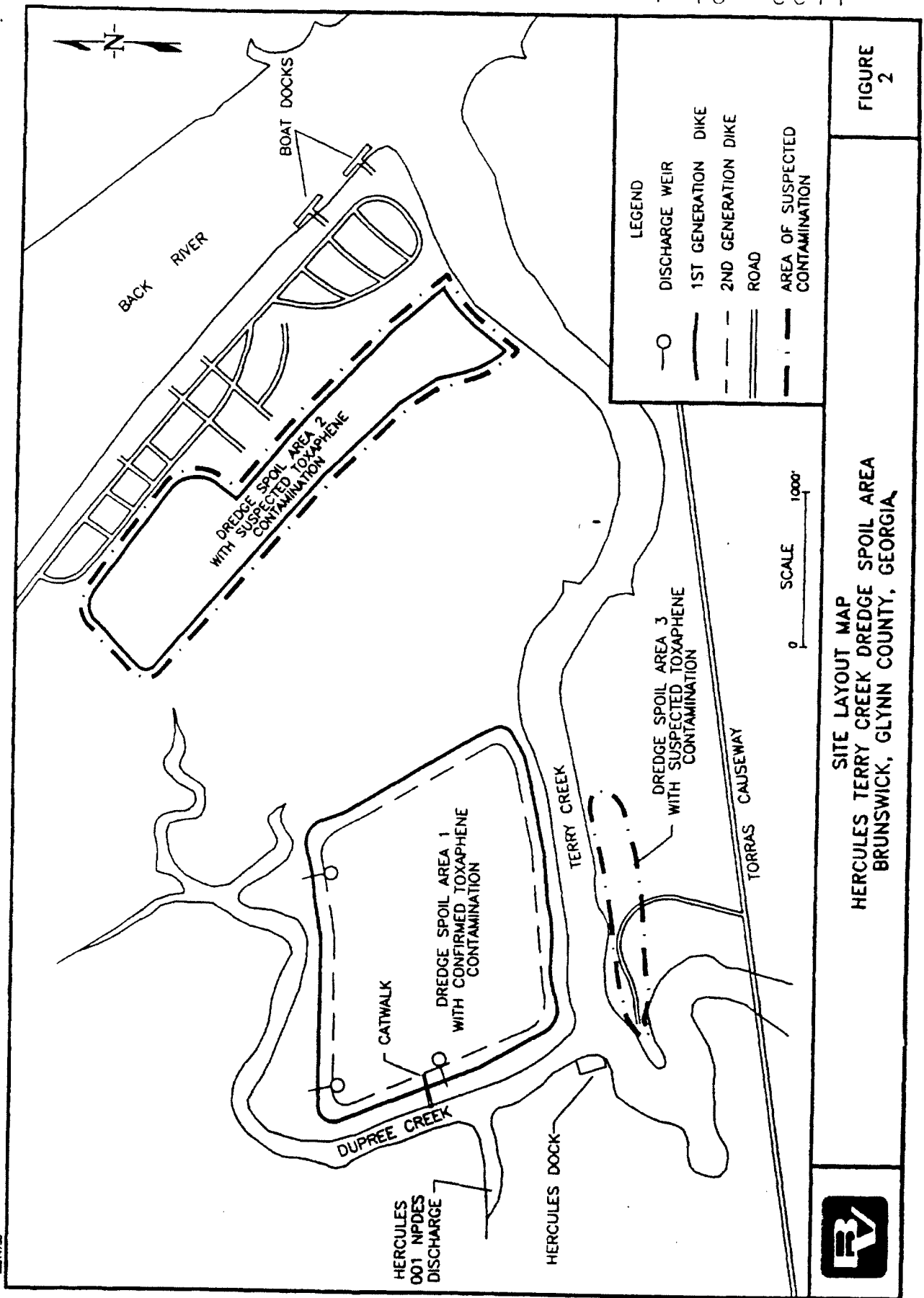
SITE LOCATION MAP
 HERCULES TERRY CREEK DREDGE SPOIL AREA
 BRUNSWICK, GLYNN COUNTY, GEORGIA

FIGURE
 1

CAD DWG NO: 001-001
 CREATION DATE: 01-08-83
 DRAFTERS INITIALS: 00
 3/21/79

ORIGINAL DWG SIZE
 11 x 8.5
 PLOT SCALE: 1=1

MOST RECENT REVISION:
 REVISION DATE: 1-13-87
 DRAFTERS INITIALS: 00



Maintenance dredging was performed by the US Army Corps of Engineers (USACE) during 1940, 1941, 1942, 1946, 1972, 1978, 1982, 1986, 1987, and 1988. Maintenance dredging was originally scheduled to be performed every two years (Refs. 6, p. 1; 7).

Since 1938, the Terry Creek Project's primary channel user has been Hercules, Inc., which is a chemical manufacturer that imported raw materials, such as tree stumps, via Terry Creek. The Hercules, Inc., plant is located adjacent to Dupree Creek, approximately 2,000 feet north of its confluence with Terry Creek (Refs. 1; 6, p. 1; 7). Hercules, Inc., produced toxaphene from 1948 until its use was banned in 1980. Hercules, Inc., discharged approximately 250-300 pounds per day of toxaphene into Terry Creek prior to 1972, when the Clean Water Act mandated that Hercules, Inc., build and utilize a water treatment plant to control and minimize the amount of toxaphene it discharged (Refs. 6, p. 1; 8).

In 1972, Hercules, Inc., spilled an unknown quantity of toxaphene into Terry Creek from a transport barge (Refs. 6, p. 1; 9; 10). Subsequent to the spill, the USACE, Savannah District, worked with state and Federal officials, the City of Brunswick, and Hercules, Inc., to identify and acquire a dredge disposal area to accommodate any future dredge spoils from Terry Creek (Refs. 6, p. 2; 10). The City of Brunswick and Hercules, Inc., were both active in acquiring easements for the dredge disposal area. Hercules, Inc., is part owner of at least one tract of the disposal area (Ref. 6, p. 2). Hercules, Georgia EPD, and EPA entered into an agreement in 1972 or 1973 which stated that dredged material would be deposited only in a surface impoundment (Dredge Disposal Area 1) located at the Hercules Terry Creek Dredge Spoil Area (Refs. 6, p. 2; 9, p. 1; 10). During subsequent dredgings, USACE deposited the following quantities of potentially toxaphene-contaminated dredge material into the surface impoundment (Dredge Disposal Area 1) located at the Hercules Terry Creek Dredge Disposal Area (Ref. 11):

Jan. 20 through May 20, 1978	354,875 cubic yards (cy)
Oct. 27, 1982 through March 8, 1983	267,180 cy
April 30 through June 1, 1987	254,156 cy
Aug. 1 through Dec. 6, 1988	172,220 cy

In 1975, Hercules, Inc., received its first National Pollution Discharge Elimination System (NPDES) permit for an outfall identified as 001. The permit restricted its discharge of toxaphene to a daily maximum of 1 pound per day and a daily average of 0.5 pound per day. During subsequent permit renewals, the toxaphene discharge

limitation was reduced to its present day limit of 0.00081 micrograms per liter ($\mu\text{g/L}$) based on a flow rate of eight million gallons per day (mgd) (Ref. 12). From July 1988 until July 1993, Hercules, Inc., violated its discharge limitation for toxaphene six times (Ref. 13). Hercules, Inc., ceased production of toxaphene in December 1980 (Ref. 6, p. 1). Georgia Environmental Protection Division (EPD) does not maintain database records prior to 1988; therefore, it is not known if any violations occurred prior to that time (Refs. 12; 13). Hercules, Inc., is presently implementing its "Best Management Practices Plan" to prevent further violations of its NPDES permit (Ref. 14).

The owner/developer of Riverside Developments I and II and longtime resident of the area informed Black & Veatch personnel during field activities that, many years ago, dredge material was deposited at the south end of Area 2 (Ref. 5, Vol. 1, p. 3).

2.3.2 Previous Investigations and Waste Characteristics

Several studies have been conducted to assess toxaphene contamination at Hercules Terry Creek Dredge Disposal Area. The University of Georgia Marine Institute monitored toxaphene concentrations in aquatic plants and fish in Terry Creek from 1971 to 1972. The subsequent report concluded that levels during 1972 had declined in comparison to levels observed in 1971 (Refs. 15; 16, pp. 2-7).

From January 15 through 31, 1986, USACE conducted a study which evaluated geotechnical soil borings in Area 1 and analyzed a limited number of samples for toxaphene. Laboratory analyses confirmed the presence of toxaphene in surface soil samples and in soil samples collected at two feet below land surface (bls); however, samples collected at greater depths were not analyzed for toxaphene (Refs. 17).

On February 4, 1986, Savannah Laboratories and Environmental Services, Inc., collected 15 sediment samples from both Terry and Dupree creeks. Results indicated that toxaphene contamination was present in the greatest concentrations in sediment samples collected along the outer bank of Terry Creek and the outer banks of the intersection of both creeks. These results may indicate that dredging operations conducted by USACE removed a significant portion of toxaphene-contaminated sediments in the main channel portion of Terry Creek while leaving a significant portion of toxaphene-contaminated sediments along the outer banks (Ref. 18).

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The Georgia Environmental Protection Division (GA EPD) conducted a Screening Site Inspection (SSI) on July 22, 1987 and August 18, 1987. On July 22, 1987 GA EPD collected seven sediment and six water samples; however, the SSI report does not indicate the exact sample locations (Ref. p. 19, App. A, p. A-2). On August 18, GA EPD collected three estuarine sediment samples; however, exact sample locations are not known (Ref. 19, App. B, p. B-2). Laboratory results indicated that all media sampled were contaminated with toxaphene. Samples collected from Area 1 contained the greatest concentrations of toxaphene. In addition, 1-phenylethanone, 1,1-biphenyl, 1,1-oxybisbenzene, and benzoic acid were also present in the samples (Ref. 19, App. B). A summary of previous investigations conducted at the Hercules Terry Creek Dredge Disposal Area is provided in Table 1.

It should be noted that Hercules, Inc., also owns a landfill (Hercules 009 Landfill) located approximately three miles northwest of Area 1. Toxaphene has been detected in shallow groundwater samples collected at the landfill, which is currently on the National Priorities List (NPL). However, it is not likely that toxaphene contamination from the 009 Landfill has impacted this site due to the distance of the landfill from the Hercules Terry Creek Dredge Spoil Area (Refs. 20, 21, 22).

Toxaphene is the common name for a complex mixture of chlorinated camphenes containing between 67 and 69 percent chlorine by weight. The approximate chemical formula is $C_{10}H_{10}Cl_8$. Physically, it is a generally yellow to amber waxy solid having an odor described as pleasant and piney. Since its introduction in 1945, toxaphene was primarily used as an insecticide for foliar treatment of agricultural products (Refs. 23; 24). The maximum toxaphene usage in 1972 was recorded at 25,000 metric tons. In 1982, EPA canceled registrations for most uses of toxaphene; however, input to the environment continued since existing stocks could be utilized for various purposes through 1986. Toxaphene was identified as a priority pollutant by EPA in 1985 (Ref. 14, pp. 17, 18).

In its principal form as a solid, toxaphene has a melting point of 65 to 90 degrees Celsius. Solubility in water has been reported at 0.55 milligrams per liter at 20 degrees Celsius. The vapor pressure of toxaphene has been reported to be 6.69×10^{-6} millimeters of mercury at 25 degrees Celsius. When released in water, toxaphene will not appreciably hydrolyze, photolyze, or significantly biodegrade. It strongly adsorbs to sediments and bioconcentrates in aquatic organisms (Ref. 23, pp. 630, 631). The

Table 1
Previous Investigation Summary
Hercules Terry Creek Dredge Disposal Area
Brunswick, Glynn County, Georgia

DATE	AGENCY	EVENT/ INVESTIGATION	SAMPLES COLLECTED	ANALYTES DETECTED	REFERENCES
1970 - 1973	UGA Marine Institute	Survey of Toxaphene Levels in Georgia Estuaries	Static bioassays of estuarine organisms	Toxaphene	14; 15
January 15, 1985	USACE	Sampling Investigation	7 surface/subsurface soil	Toxaphene	16
February 4, 1996	Savannah Laboratories & Environmental Services, Inc.,	Sampling Investigation	15 sediment	Toxaphene	17
July 22, 1987	GA EPD	Screening Site Inspection	7 sediment 3 water	Toxaphene	18
August 18, 1987			3 sediment		

UGA = University of Georgia
GA EPD = Georgia Environmental Protection Division

1 10 0016
low solubility of toxaphene in water and the strong adsorption to soil/sediment particles therefore minimizes leaching of toxaphene into groundwater (Ref. 14, pp. 18, 19; 23, pp. 630-633).

Toxaphene is very persistent in the environment, and when released to soils or sediments, will last for long periods of time. Reported half-lives for toxaphene in soil range from approximately 1 to 14 years, but average approximately 10 years (Ref. 14, p. 18; 23, p. 631).

Much research has been conducted to define pathways and modes of transport for toxaphene. Since toxaphene is not a single compound, but rather a complex mixture of at least 177 individual compounds, the mechanisms affecting degradation and movement are extremely complex and not fully understood. Due to toxaphene's high adsorption coefficient, toxaphene is strongly adsorbed to soil particulates and, therefore, does not appear to be highly mobile. However, during rainfall events, toxaphene may be transported with suspended solids via overland stormwater flow into surface waters due to its high degree of sorption to soil particulates and in particular the fine fraction of soil particulates. The primary soil characteristics which influence adsorption of toxaphene onto soil particles are soil organic content, grain size distribution (specifically percentage of fines), moisture content, and pH. With few exceptions, the higher the percentage of fines, the greater the adsorption tendency and the longer the persistence in the soil (Ref. 14, pp. 18, 19; 23, pp. 631-634).

3.0 Field Investigation

The field investigation for the Hercules Terry Creek Dredge Spoil Area ESI consisted of two field efforts: a primary field investigation conducted during the week of September 19, 1995, and an addendum field investigation conducted during the week of February 28, 1996. The addendum field investigation was conducted in order to determine if toxaphene contamination was present in soils at two residential areas. Analytical data are presented in Appendix A.

3.1 Sample Collection

During the field investigations conducted the weeks of September 19, 1995, and February 28, 1996, the Black & Veatch field team attempted to identify and characterize contaminants that may be present in the environment as a result of disposal activities at the Hercules Terry Creek Dredge Disposal Area site. To accomplish this, the field team collected environmental samples from a number of strategic locations. These locations were selected based on historical information, hydrological data for the region, and direct observation at the site. The Black & Veatch field team collected samples considered necessary to support an HRS evaluation of the site. Groundwater and air migration characterizations were not considered as conducive to supporting an HRS score of the site; therefore, groundwater and air samples were not collected during this investigation. Three groundwater samples were collected, however, to determine the absence or presence of toxaphene in a residential area. The time and date of sample collection and corresponding sample identification numbers were recorded in field logbooks by Black & Veatch personnel (Ref. 5, Vols. 1 and 2).

The following deviations from the Field Study Plan (FSP) (Ref. 25), occurred during the investigation conducted the week of September 19, 1995 (Ref. 5):

- 1) Due to extreme difficulty accessing certain portions of Area 1, the following surface and subsurface soil samples were not collected: TC-SS-07, TC-SS-09, TC-SS-11, TC-SS-12, TC-SB-12, TC-SS-13, and TC-SB-13.
- 2) All subsurface soil samples were collected between 3 and 4 feet bls. No subsurface soil samples were collected at 5 or 10 feet bls as specified in the FSP.

known to inhabit the surface waters of Glynn County include the leatherback turtle (*Dermochelys coriacea*) and hawksbill turtle (*Eretmochelys imbricata*) (Ref. 48). Extensive estuarine wetlands are located along Dupree Creek, Terry Creek, the Back River, and St. Simons Sound (Refs. 1; 49). There are approximately 7 miles of wetlands located along the surface water pathway, of which 0.75 mile occurs along a stretch of the creek defined by sediment samples as indications of elevated levels of site-related contamination (Refs. 1; 49).

6.3 Surface Water Pathway Sample Locations

In order to characterize contamination in the surface water pathway three background surface water and three background sediment samples were collected. TC-SW-02 and TC-SD-02 were collected from Dupree Creek upgradient of the site. Samples TC-SW-03, TC-SD-03, TC-SW-12, and TC-SD-12 were collected from the Little River and designated as control samples for samples collected from Terry Creek and the Back River. Three surface water samples (TC-SW-04, TC-SW-05, and TC-SW-06) and three sediment samples (TC-SD-04, TC-SD-05, and TC-SD-06) were collected downstream and downgradient of the site in order to determine the presence or absence of toxaphene contamination in Dupree Creek. Three surface water samples (TC-SW-01, TC-SW-08, and TC-SW-09) and three sediment samples (TC-SD-01, TC-SD-08, and TC-SD-09) were collected in order to determine the presence or absence of toxaphene contamination in Terry Creek. One surface water and one sediment sample (TC-SW-07 and TC-SD-07) were collected from the confluence of Dupree and Terry creeks. One surface water and one sediment sample (TC-SW-11 and TC-SD-11) were collected from the NPDES outfall drainage ditch leading to Terry Creek. A surface water and sediment sample (TC-SW-10 and TC-SD-10) were collected to determine if toxaphene contamination is migrating downstream to the Back River.

Five wetland sediment samples were collected to determine if actual contamination had occurred in a sensitive environment. Wetland sediment sample TC-WSD-01 was collected in a wetland north of Area 1 on Dupree Creek. Sample TC-WSD-02 was collected south of Torras Causeway on Terry Creek and TC-WSD-03 was collected south of Area 1 on Terry Creek. Sample TC-WSD-04 was collected from wetlands located at the confluence of Terry Creek and the Back River and TC-WSD-05 was collected from wetlands located on Terry Creek between the Hercules, Inc., dock and the confluence of Terry Creek and the Back River. TC-WSD-03 was designated as the wetland sediment control sample. Surface water and sediment sampling locations are shown on Figures 3 and 4 and described in Table 2.

- 1 13 0019
- 3) Long-time resident and owner/developer of Riverside Developments I and II, informed Black & Veatch field personnel that dredge material was deposited at the south end of Area 2. Therefore, one surface and one subsurface soil sample (TC-SS-17 and TC-SB-17) were added and collected from the south central portion of Area 2.
 - 4) Specialized toxaphene screening was not performed for Area 2 samples.

The following deviations from the Addendum to Field Study Plan (AFSP) (Ref. 26), occurred during the investigation conducted the week of February 28, 1996 (Ref. 5):

- 5) Samples TC-CS-SS-02, TC-CS-SS-09, and TC-CS-SS-19 were not collected and sample TC-CS-SS-12 was moved because residential structures adjacent to planned sample locations were found to be absent during the field effort.
- 6) One of five planned sample aliquots for samples TC-CS-SS-20 and TC-CS-SS-21 was not taken due to physical obstructions on the field.
- 7) Two of five planned sample aliquots for sample TC-CS-SS-16 were taken at alternate locations due to physical obstructions on the field.
- 8) All sample aliquots for sample TC-CS-SS-23 were collected from revised locations due to a building addition to the nursing home.
- 9) Two grab surface and two subsurface soil samples were collected from the Riverside neighborhood (TC-RS-SS-01, TC-RS-SS-02, TC-RS-SB-01, and TC-RS-SB-02), located adjacent to Area 2, as requested by the EPA Site Assessment Manager.
- 10) One composite surface and subsurface soil sample was collected from the Burroughs-Molette Elementary School (TC-MB-SS-01 and TC-MB-SB-01), located in approximately 2 miles southeast of Area 1, as requested by the EPA Site Assessment Manager.

3.1.1 Split Samples

During the field investigation conducted during the week of September 19, 1995, split samples were offered to and accepted by Tim Hassett of Hercules, Inc. No samples were split during the addendum field investigation conducted during the week of February 28, 1996. Receipt for sample forms are on file at the Atlanta office of Black & Veatch.

3.1.2 Description of Sample Locations

Sampling locations for surface and subsurface soil, groundwater, and sediment samples are described in their respective sections, are shown on Figures 3, 4, 5, 6, 7 and 8, and are listed in Table 2.

3.1.3 Field Measurements

Field pH, conductivity, temperature, and turbidity measurements were recorded on all groundwater samples collected during this investigation and were recorded in the field logbook by Black & Veatch personnel (Ref. 5, Vol. 1, pp. 12-15, and 20). These measurements are presented in Table 3. No field measurements were conducted on soil or sediment samples.

Field Global Positioning System (GPS) measurements for latitude and longitude coordinates were attempted for all sample locations at or near the actual sample locations. At least one GPS reading was recorded for the location closest to the sample location that did not induce interference from trees or other overhead objects. These measurements are presented along with the appropriate sample code and sample location in Table 2.

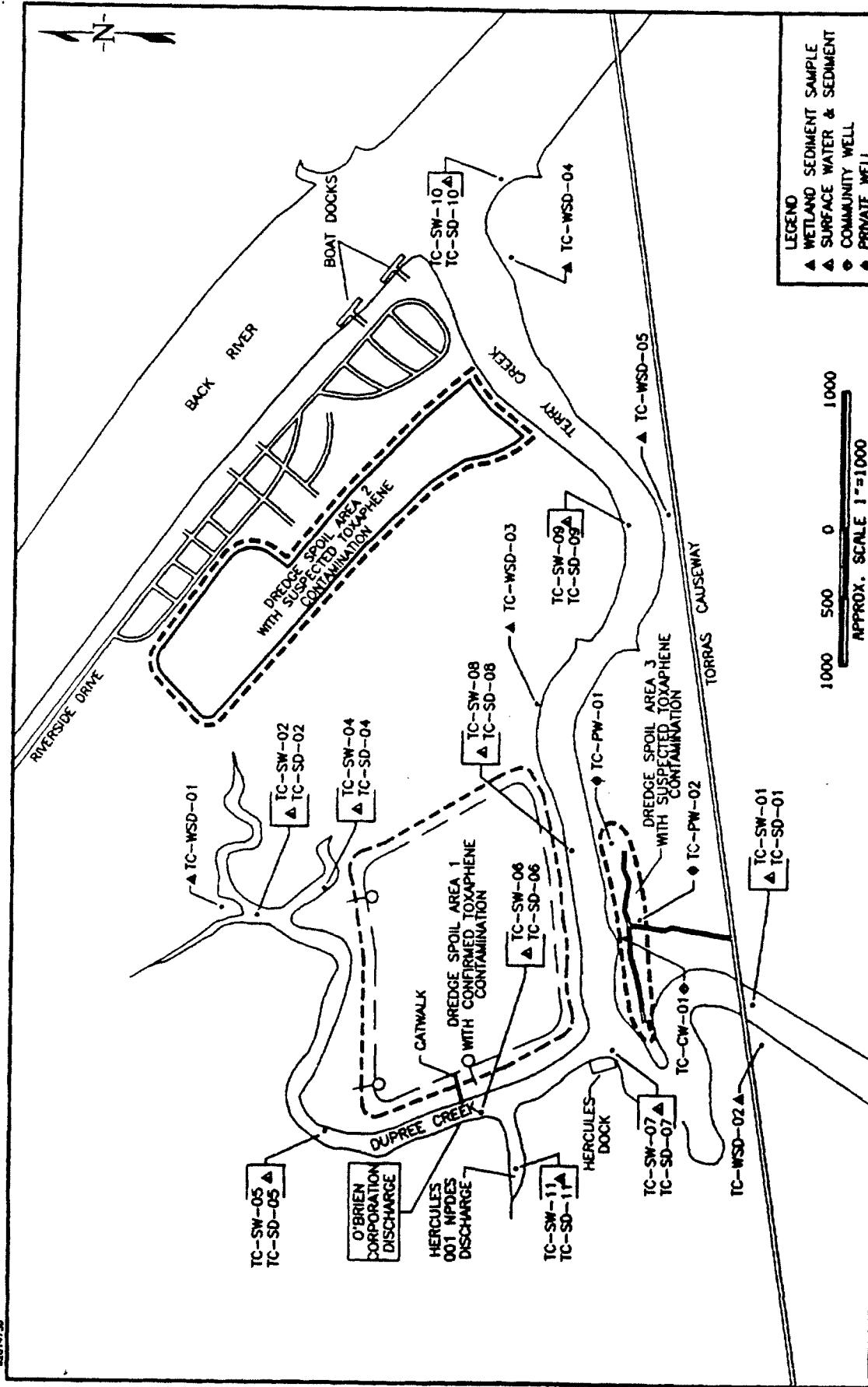
3.1.4 Analytical Support and Methodology

All samples were collected and preserved in accordance with EPA Region IV ESD Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, February 1, 1991. All samples collected were analyzed under the Contract Laboratory Program (CLP). Samples were analyzed for all organic parameters listed in the Target Compound List (TCL) and all inorganic parameters in the Target Analyte List (TAL). Inorganic analyses of soil and water samples collected during this investigation were performed by Skinner and Sherman, located in Waltham, Massachusetts. Organic analyses were performed by Clayton Environmental Consultants, Pleasanton, California. Select sediment, surface and subsurface soil samples were also sent to EPA, Region IV, ESD, located in Athens,

CAD DWG NO: 10000000
 CREATION DATE: 8-1-98
 DRAWING DETAILS: 08
 52014750

ORIGINAL DWG SIZE
 11 x 8.5
 PLOT SCALE: 1"=1'

MOST RECENT REVISION:
 REVISION DATE: 1-15-97
 DRAWING DETAILS: 08



**SURFACE WATER/SEDIMENT AND WELL
 SAMPLE LOCATION MAP**
HERCULES TERRY CREEK DREDGE SPOIL AREA
BRUNSWICK, GLYNN COUNTY, GEORGIA

**FIGURE
 3**

CAD Dwg NO: 22000000
 CREATION DATE: 08-01-00
 DRAFTERS: BTH/LS: 00
 ORIGINAL DWG SIZE: 11" x 17"
 PLOT SCALE: 1"=1 MI
 MOST RECENT REVISION: 8-8-05
 REVISION DATE: 8-8-05
 DRAFTERS: BTH/LS: 00



EXTENDED SURFACE WATER/SEDIMENT AND SURFACE/SUBSURFACE SOIL
 SAMPLE LOCATION MAP
 HERCULES TERRY CREEK DREDGE SPOIL AREA
 BRUNSWICK, GLYNN COUNTY, GEORGIA

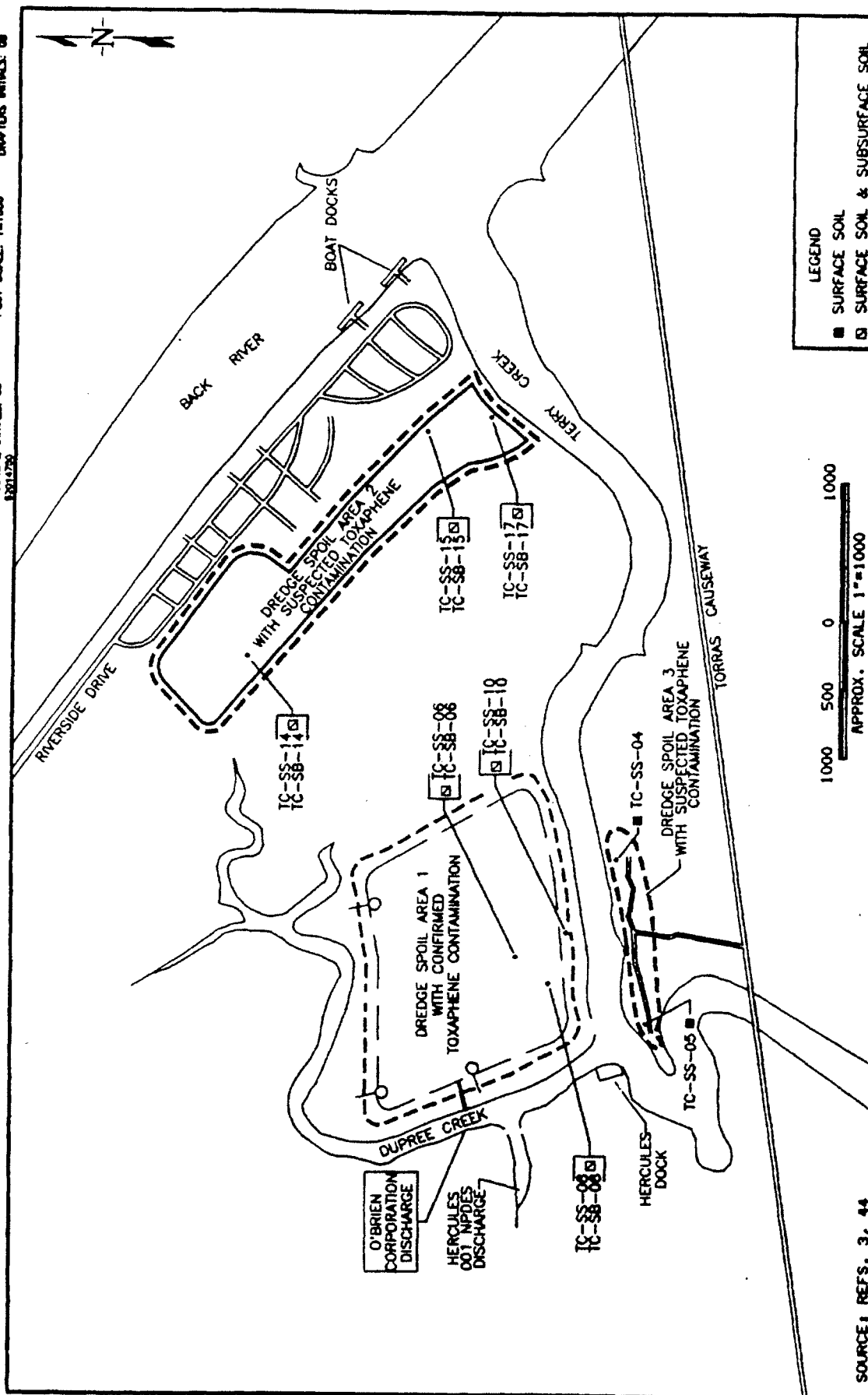


FIGURE 4

CAD DWG NO: E2844401
 CREATION DATE: 01-08-03
 DRAFTERS INITIALS: GB
 \$2014750

ORIGINAL DWG SIZE
 11" x 8 1/2"
 PLOT SCALE: 1"=1000

MOST RECENT REVISION:
 REVISION DATE: 1-13-97
 DRAFTERS INITIALS: GB



LEGEND
 ■ SURFACE SOIL
 □ SURFACE SOIL & SUBSURFACE SOIL

1000 500 0 1000
 APPROX. SCALE 1"=1000

SOURCE: REFS. 3, 44

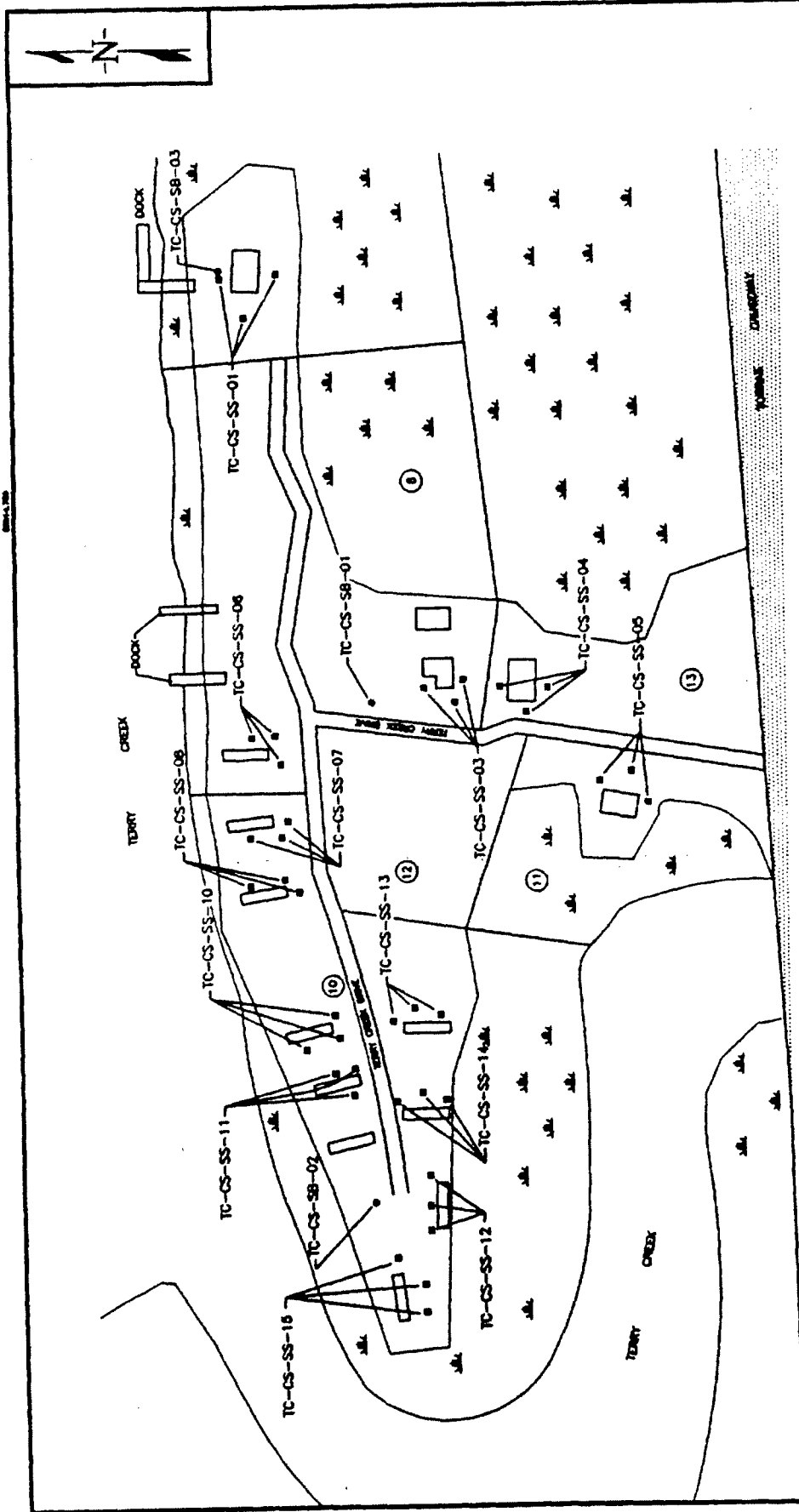


SURFACE SOIL AND SUBSURFACE SOIL
 SAMPLE LOCATION MAP
 HERCULES TERRY CREEK DREDGE SPOIL AREA
 BRUNSWICK, GLYNN COUNTY, GEORGIA

FIGURE
 5

CAD DWG NO: ERT00003
 CREATION DATE: 1-18-06
 DRAFTING DETAILS: 06
 MOST RECENT REVISION:
 REVISION DATE: 1-18-07
 DRAFTING DETAILS: 07

ORIGINAL DWG SIZE:
 11" x 8"
 PLOT SCALE: 1:100



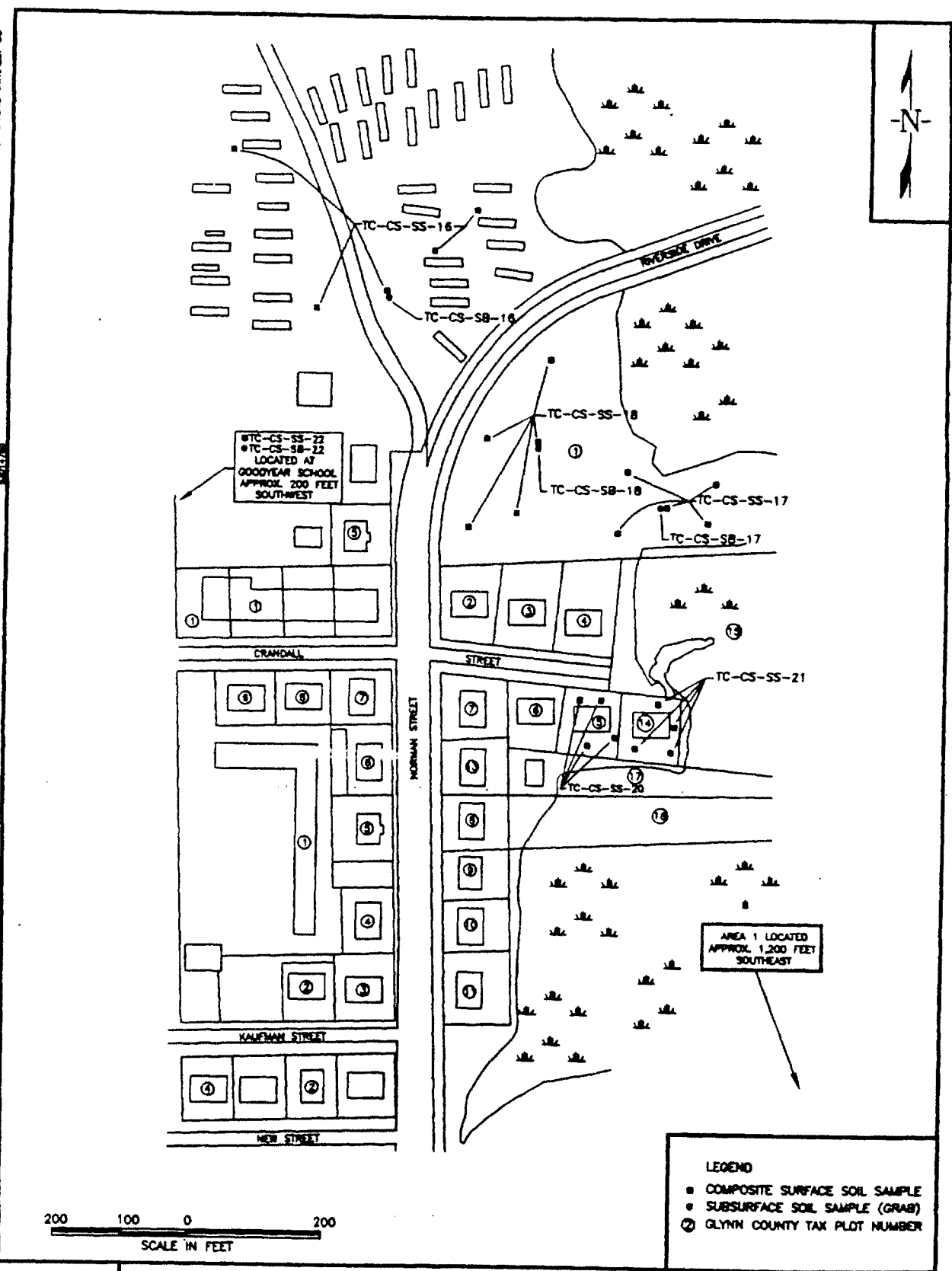
- LEGEND
- TC-CS-SS-05 COMPOSITE SURFACE SOIL SAMPLE
 - TC-CS-SB-02 SUBSURFACE SOIL SAMPLE (GRAB)
 - ⑪ GLYNN COUNTY TAX PLOT NUMBER

ADDENDUM SAMPLE LOCATION MAP
 TERRY CREEK DRIVE
 HERCULES TERRY CREEK DREDGE SPOIL AREA 3
 BRUNSWICK, GLYNN COUNTY, GEORGIA



FIGURE
6

CAD DWG NO: 1000001
 CREATION DATE: 1-18-06
 DRAFTER INITIALS: 08
 MOST RECENT REVISION:
 REVISION DATE: 1-18-07
 DRAFTER INITIALS: 08
 ORIGINAL DWG SIZE:
 8.5" x 11"
 PLOT SCALE: 1"=100'



ADDENDUM SAMPLE LOCATION MAP
 CRANDALL STREET/RIVERSIDE DRIVE
 HERCULES TERRY CREEK DREDGE SPOIL AREA
 BRUNSWICK, GLYNN COUNTY, GEORGIA

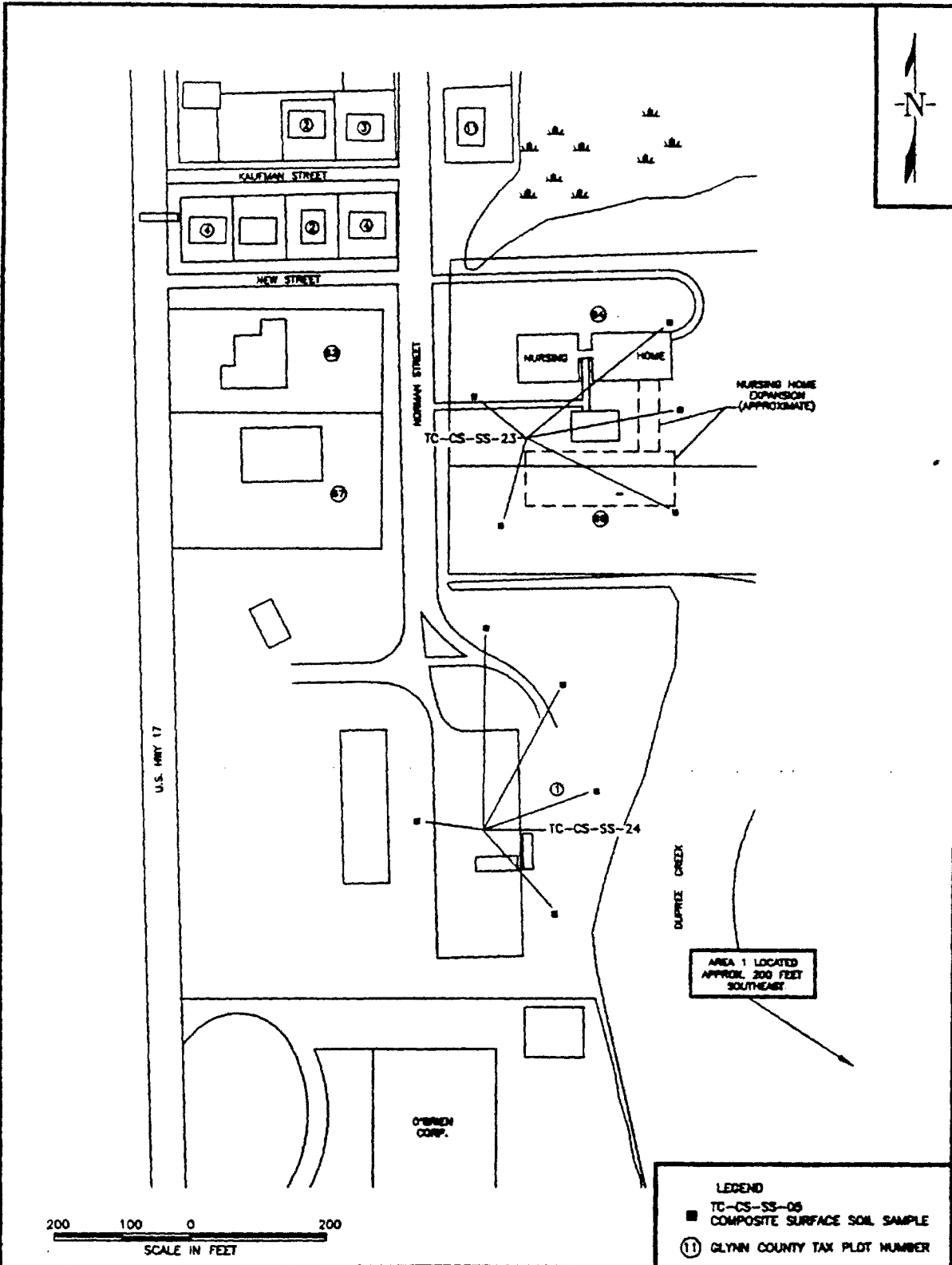
FIGURE
 7

1.0 0026

CAD DWG NO: ESTIMAS
CREATION DATE: 1-18-00
DRAFTERS INITIALS: 00
BRUNSWICK

ORIGINAL DWG SIZE:
8.5 x 11
PLOT SCALE: 1=100

MOST RECENT REVISION:
REVISION DATE: 7-9-00
DRAFTERS INITIALS: 00



ADDENDUM SAMPLE LOCATION MAP
NORMAN STREET
HERCULES TERRY CREEK DREDGE SPOIL AREA
BRUNSWICK, GLYNN COUNTY, GEORGIA

FIGURE
8

1 16 0027

Table 2
HERCULES TERRY CREEK DREDGE SPOIL AREA
Sample Locations

Sample Code	Sample Type	Descriptive Sample Location	Global Positioning System (GPS) Location
SEPTEMBER 19, 1995			
TC-SW-01 TC-SD-01	Surface Water/ Sediment	South of Torres Causeway on Terry Creek.	Latitude: 31° 09' 65" N Longitude: 81° 28' 18" W Position from LORAN (boat equipment) not GPS.
TC-SW-02 TC-SD-02	Surface Water/ Sediment	Upgradient of site on Dupree Creek.	Latitude: 31° 10' 1799" N Longitude: 81° 28' 0086" W
TC-SW-03 TC-SD-03	Surface Water/ Sediment	Approximately 3/4 mile east-northeast of site on first major left tributary of Little River above confluence with Back River.	Latitude: 31° 10' 4000" N Longitude: 81° 26' 4225" W
TC-SW-04 TC-SD-04	Surface Water/ Sediment	Small branch of Dupree Creek near northeast discharge weir of Area 1.	Latitude: 31° 10' 1225" N Longitude: 81° 28' 0026" W
TC-SW-05 TC-SD-05	Surface Water/ Sediment	Dupree Creek northwest of Area 1.	Latitude: 31° 10' 1471" N Longitude: 81° 28' 1695" W
TC-SW-06 TC-SD-06	Surface Water/ Sediment	Dupree Creek west of impoundment 1 and downstream of O'Brien Corporation discharge.	Latitude: 31° 10' 1366" N Longitude: 81° 28' 1331" W
TC-SW-07 TC-SD-07	Surface Water/ Sediment	Confluence of Terry and Dupree Creeks at the Hercules dock.	Latitude: 31° 09' 5264" N Longitude: 81° 28' 1540" W
TC-SW-08 TC-SD-08	Surface Water/ Sediment	Terry Creek between Area 1 and Area 3.	Latitude: 31° 09' 5213" N Longitude: 81° 27' 5859" W
TC-SW-09 TC-SD-09	Surface Water/ Sediment	Midpoint of Terry Creek between Back River confluence and Hercules dock.	Latitude: 31° 10' 4887" N Longitude: 81° 27' 2871" W
TC-SW-10 TC-SD-10	Surface Water/ Sediment	Back River just downriver of confluence with Terry Creek.	Latitude: 31° 10' 031" N Longitude: 81° 27' 02" W (LORAN readings.) Latitude: 31° 10' 0310" N Longitude: 81° 26' 5944" W (GPS readings.)
TC-SW-11 TC-SD-11	Surface Water/ Sediment	001 outfall drainage ditch leading to Terry Creek.	Latitude: 31° 10' 0202" N Longitude: 81° 28' 2325" W
TC-SW-12 TC-SD-12	Surface Water/ Sediment	Approximately 1 1/4 miles north-northeast of site on Little River.	Latitude: 31° 11' 0872" N Longitude: 81° 26' 4707" W
TC-WSD-01	Wetland Sediment	Upgradient of site on Dupree Creek.	Latitude: 31° 10' 1011" N Longitude: 81° 28' 0023" W
TC-WSD-02	Wetland Sediment	South of Torres Causeway on Terry Creek.	No readings taken.
TC-WSD-03	Wetland Sediment	Downgradient of Area 1 on Terry Creek.	Latitude: 31° 09' 5441" N Longitude: 81° 27' 4061" W
TC-WSD-04	Wetland Sediment	Wetlands at confluence of Terry Creek and Back River.	Latitude: 31° 09' 97" N Longitude: 81° 27' 20" W (LORAN readings.) Latitude: 31° 10' 0370" N Longitude: 81° 27' 0991" W (GPS readings.)
TC-WSD-05	Wetland Sediment	Midpoint of Terry Creek between Back River confluence and Hercules dock.	Latitude: 31° 09' 4640" N Longitude: 81° 27' 2822" W

TC - Hercules Terry Creek Dredge Spoil Area
SW - Surface Water Sample

SD - Sediment Sample
WSD - Wetland Sediment Sample

Table 2 (Continued)
HERCULES TERRY CREEK DREDGE SPOIL AREA
Sample Locations

Sample Code	Sample Type	Descriptive Sample Location	Global Positioning System Location
SEPTEMBER 19, 1995 (Continued)			
TC-PW-01	Private Well	Eastern portion of Dredge Spoil Area 3.	No readings taken.
TC-PW-02	Private Well	South central portion of Dredge Spoil Area 3.	No readings taken.
TC-CW-01	Community Well	North central portion of Dredge Spoil Area 3.	No readings taken.
TC-SS-01	Surface Soil	On west road shoulder of road to Back River residential area out from mainland.	No readings taken.
TC-SB-01	Subsurface Soil	On west road shoulder of road to Back River residential area out from mainland (approximately 3.5' bts).	No readings taken.
TC-SS-02	Surface Soil	Central eastern portion of Back River residential area extending past dredge spoil area at [REDACTED]	Latitude: 31° 10' 3123" N Longitude: 81° 27' 4053" W
TC-SB-02	Subsurface Soil	Central eastern portion of Back River residential area extending past dredge spoil area (approximately 3' bts).	See GPS readings for TC-SS-02.
TC-SS-03	Surface Soil	Central western portion of Back River residential area extending past dredge spoil area near [REDACTED]	Latitude: 31° 10' 3167" N Longitude: 81° 27' 4866" W
TC-SB-03	Subsurface Soil	Central western portion of Back River residential area extending past dredge spoil area near [REDACTED] (approximately 3' bts).	See GPS readings for TC-SS-03.
TC-SS-04	Surface Soil	East end of Area 3.	Latitude: 31° 09' 5157" N Longitude: 81° 27' 5664" W
TC-SS-05	Surface Soil	West end of Area 3.	Latitude: 31° 09' 4956" N Longitude: 81° 28' 1458" W
TC-SS-06	Surface Soil	Southwestern portion of Dredge Spoil Area 1.	No readings taken.
TC-SB-06	Subsurface Soil	Southwestern portion of Dredge Spoil Area 1 (approximately 4' bts).	No readings taken.
TC-SS-08	Surface Soil	Southwest quadrant of Area 1.	No readings taken.
TC-SB-08	Subsurface Soil	Southwest quadrant of Area 1 (approximately 4' bts).	No readings taken.
TC-SS-10	Surface Soil	Top of bermed area along southernmost edge of Dredge Spoil Area 1.	No readings taken.
TC-SB-10	Subsurface Soil	Top of bermed area along southernmost edge of Dredge Spoil Area 1 (approximately 4' bts).	No readings taken.

TC - Hercules Terry Creek Dredge Spoil Area
PW - Private Well Sample
CW - Community Well Sample
SB - Subsurface Soil Sample
SS - Surface Soil Sample

Table 2 (continued)
HERCULES TERRY CREEK DREDGE SPOIL AREA
Sample Locations

Sample Code	Sample Type	Descriptive Sample Location	Global Positioning System (GPS) Location
SEPTEMBER 19, 1995 (Continued)			
TC-SS-14	Surface Soil	Northwest end of Area 2.	Latitude: 31° 10' 0907" N Longitude: 81° 27' 3208" W
TC-SB-14	Subsurface Soil	Northwest end of Area 2 (approximately 4' bls).	See GPS readings for TC-SS-14.
TC-SS-15	Surface Soil	Central portion of Area 2.	Latitude: 31° 10' 0133" N Longitude: 81° 27' 1760" W
TC-SB-15	Subsurface Soil	Central portion of Area 2 (approximately 4' bls).	See GPS readings for TC-SS-15.
TC-SS-16	Surface Soil	Near dock and railroad track area along road to Back River residential area.	No readings taken.
TC-SB-16	Subsurface Soil	Near dock and railroad track area along road to Back River residential area (approximately 3.5' bls).	No readings taken.
TC-SS-17	Surface Soil	Central eastern portion of Area 2.	Latitude: 31° 10' 0065" N Longitude: 81° 27' 1397" W
TC-SB-17	Subsurface Soil	Central eastern portion of Area 2 (approximately 4' bls).	See GPS readings for TC-SS-14.
FEBRUARY 28, 1996			
TC-CS-SS-01	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-03	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-04	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-05	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-06	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-07	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-08	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-10	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-11	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-12	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-13	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-14	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SS-15	Composite Surface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.

TC - Hercules Terry Creek Dredge Spoil Area
SS - Surface Soil Sample

SB - Subsurface Soil Sample
CS - Community Sample

1 10 0030

Table 2 (continued)
HERCULES TERRY CREEK DREDGE SPOIL AREA
Sample Locations

Sample Code	Sample Type	Descriptive Sample Location	Global Positioning System (GPS) Location
FEBRUARY 28, 1996 (Continued)			
TC-CS-SS-16	Composite Surface Soil	Northwest of area 1 adjacent to Norman Street.	Latitude: 31°10'34.84"N Longitude: 81°28'20.89"W
TC-CS-SS-17	Composite Surface Soil	Northwest of area 1 adjacent to Crandall Street.	Latitude: 31°10'30.04"N Longitude: 81°28'14.27"W
TC-CS-SS-18	Composite Surface Soil	Northwest of area 1 adjacent to Riverside Drive.	Latitude: 31°10'30.29"N Longitude: 81°28'17.29"W
TC-CS-SS-20	Composite Surface Soil	Northwest of area 1 adjacent to Crandall Street.	Latitude: 31°10'26.20"N Longitude: 81°28'22.29"W
TC-CS-SS-21	Composite Surface Soil	Northwest of area 1 adjacent to Crandall Street.	Latitude: 31°10'26.70"N Longitude: 81°28'17.07"W
TC-CS-SS-22	Composite Surface Soil	Goodyear School	Latitude: 31°10'20.59"N Longitude: 81°28'31.08"W
TC-CS-SS-23	Composite Surface Soil	West of Area 1, adjacent to Norman Street and Dupree Creek	No readings taken.
TC-CS-SS-24	Composite Surface Soil	West of Area 1, adjacent to Norman Street and Dupree Creek	No readings taken.
TC-MB-SS-01	Composite Surface Soil	Burroughs-Molette School playground.	Latitude: 31°09'32.03 Longitude: 81°29'13.47"
TC-RS-SS-01	Surface Soil	Riverside Neighborhood , adjacent to Area 2	No readings taken.
TC-RS-SS-02	Surface Soil	Entrance to Riverside Neighborhood , adjacent to Area 2	No readings taken.
TC-CS-SB-01	Subsurface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SB-02	Subsurface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SB-03	Subsurface Soil	Area 3 adjacent to Terry Creek Drive.	No readings taken.
TC-CS-SB-16	Subsurface Soil	Northwest of area 1 adjacent to Norman Street.	Latitude: 31°10'34.84"N Longitude: 81°28'20.89"W
TC-CS-SB-17	Subsurface Soil	Northwest of area 1 adjacent to Norman Street.	Latitude: 31°10'30.04"N Longitude: 81°28'14.27"W
TC-CS-SB-18	Subsurface Soil	Northwest of area 1 adjacent to Norman Street.	Latitude: 31°10'30.29"N Longitude: 81°28'17.29"W
TC-CS-SB-22	Subsurface Soil	Goodyear School	Latitude: 31°10'20.20"N Longitude: 81°28'23.70"W
TC-MB-SB-01	Subsurface Soil	Burroughs-Molette School playground	Latitude: 31°09'32.03 Longitude: 81°29'13.47"
TC-RS-SB-01	Subsurface Soil	Riverside Neighborhood , adjacent to Area 2	No readings taken.
TC-RS-SB-02	Subsurface Soil	Entrance to Riverside Neighborhood , adjacent to Area 2	No readings taken.

TC - Hercules Terry Creek Dredge Spoil Area
SS - Surface Soil Sample
SB - Subsurface Soil Sample
CS - Community Sample

1 10 0031

TABLE 3 Field Measurements of Water Samples Hercules Terry Creek Dredge Spoil Area Brunswick, Glynn County, Georgia				
SAMPLE CODE	pH	Conductivity (μmhos/cm)	Temperature ($^{\circ}$F)	Turbidity (NTU)
TC-PW-01	7.76	395	76.5	1.42
TC-PW-02	7.43	406	74.0	5.06
TC-CW-01	7.30	410	78.1	0.33
NOTES: μ mhos/cm micromhos per centimeter. $^{\circ}$ F degrees Fahrenheit. NTU Nephelometric Turbidity Units.				

Georgia, for a modified EPA SW-846 method 8080 analysis of toxaphene. The complete set of analytical data is presented in Appendix A.

3.1.5 Analytical Data Quality and Data Qualifiers

All analytical data were subjected to a quality assurance review as described in the EPA Laboratory Data Validation National Functional Guidelines (Refs. 27, 28). In the tables presented, some of the concentrations of the organic and inorganic analyses may have been assigned a "J" qualifier. This indicates that the qualitative analysis was acceptable, but the quantitative value is an estimate (Ref. 29). Other analyses may have been assigned an "N" qualifier, indicating that they were detected based on the presumptive evidence of their presence. This means that the compound is only tentatively identified, and its detection is not unequivocal proof of its presence. The results for some of the samples are assigned a "U" qualifier. This qualifier indicates that the contaminant was analyzed for but not detected above the sample quantitation limit (SQL) for that sample. The reported number is the laboratory-derived SQL for the compound or element in that sample. At times, miscellaneous organic compounds that do not appear on the target compound list are reported with a data set. These compounds are assigned a "JN" qualifier, indicating that they are tentatively identified at estimated quantities. Because these compounds are not routinely analyzed for, background levels or SQLs are not generally available for comparison. The complete set of analytical data sheets is provided in Appendix A of this report. Several data discrepancies such as contaminants present in the trip blank sample were noted during this investigation. These discrepancies are discussed in the following sections as they are applicable.

Samples containing concentrations of contaminants greater than three times those of the background sample are considered to be elevated. In the cases where there was no detection of a contaminant at the background location, any sample with a concentration above its SQL and above the background SQL is considered to be elevated. These samples are shaded in the analytical results tables and are noted in the text.

4.0 Waste Sources

4.1 Source Descriptions

According to information provided by USACE, several easements within the Hercules Terry Creek Dredge Disposal Area site have been allocated for dredge spoil disposal; although, Hercules, Georgia EPD, and EPA reportedly entered into an agreement in 1972 or 1973 which stated that dredged material would be deposited only in Area 1 (Refs. 6, pp. 21, 23, 25, 26, 35, 38, 42, 46, 47, 77, 81, and attached map; 8; 9). In addition to Area 1, Dredge Spoil Area 2 (Area 2), located adjacent to a residential housing development approximately 2,000 feet east of Area 1, is an easement available for dredge spoil disposal. Area 2 is reportedly owned by Riverside Development Company (Refs. 1; 5, Vol. 1, pp. 1, 1a; 6, pp. 7, 12, 47, 77, also see attached map). Another area (Dredge Disposal Area 3 [Area 3]), located south of and adjacent to Terry Creek, is also a designated dredge disposal easement. Terry Creek Trailer Park is presently located on Area 3 (Refs. 1; 5, Vol. 1, pp. 1a, 8, 23; 6, pp. 21, 23, 25, 35, 46, 47, 81 and attached map). Although the available file material does not confirm dredge spoils deposition at Areas 2 and 3, analyses of surface soil samples collected from these areas during the ESI revealed elevated levels of toxaphene (Ref. 6, pp. 1, 2). See Appendix A for analytical results. Long-time resident and owner of Riverside Development, Mr. Ellzey, informed Black & Veatch field personnel that dredge spoil disposal did occur at Area 2 (Ref. 5, Vol. 1, p. 3).

Dredge Disposal Area 1 is estimated from topographic maps and USACE dike construction plans to be approximately 72 acres (Refs. 1; 30). Area 1 is currently surrounded by a two generation, 22-foot high dike; however, the second generation dike was reportedly constructed from contaminated dredge material (Ref. 18, pp. C-1, C-5). There is also evidence that the dike does not provide adequate containment for Area 1 (Ref. 31, pp. 3, 10, 12, and 14). Area 1 is drained by three weirs which are located in the northeast corner, the northwest corner, and the western side of the impoundment, respectively, as indicated on Figure 2. Area 1 was operated by depositing dredge spoil and allowing particulates to settle. The resulting decanted water was then drained out of the three weirs directly into Dupree Creek (Refs. 18, p. 2; 30). During the Screening Site Inspection performed by Georgia EPD in 1987, it was observed that the impoundment was full of stained soil. It did not appear to be lined nor was runoff controlled in any way (Ref. 18, App. C, Att. 1). Dredge Disposal Area 2 is estimated to be approximately 58 acres, and Dredge Disposal

Area 3 is estimated to be approximately 7 acres (Ref. 1). Area 2 is a potential residential area, Area 3 is a residential area, and both have no containment features (Refs 1; 5, Vol. 1, pp. 1a, 3, 29).

It should also be noted that sediments underneath and surrounding the Hercules dock (Figure 2), the alleged location of the 1972 toxaphene spill, most likely have not ever been dredged; therefore, high levels of contamination may still exist (Refs. 8; 9). Also, USACE dredging activities probably would have occurred in the middle of the Terry Creek channel in order to maintain a navigable passage. Therefore, dredging activities may not have impacted existing contamination at the creek boundaries (Ref. 18). There is no documentation to support that Dupree Creek sediments were dredged by USACE. Therefore, Dupree Creek sediments may also contain significant levels of toxaphene. Dupree Creek is suspected to contain toxaphene due to the presence of the NPDES-permitted discharge, the impact of a tidally-influenced river spreading contamination upstream from the Hercules dock, and the resulting discharge of storm and dredge spoil water runoff from the dredge spoil impoundment in Area 1.

4.2 Source Sampling Locations

Background surface and subsurface soil samples TC-SS-02, TC-SB-02, TC-SS-03, and TC-SB-03 were collected from an upgradient area located in the Back River residential area. Three surface (TC-SS-06, TC-SS-08, and TC-SS-10) and three subsurface soil samples (TC-SB-06, TC-SB-08, and TC-SB-10) were collected from Area 1 to aid in source characterization. Three surface (TC-SS-14, TC-SS-15, and TC-SS-16) and three subsurface soil samples (TC-SB-14, TC-SB-15, and TC-SB-16) were collected from Area 2 and two surface (TC-SS-04 and TC-SS-05) were collected from Area 3 to aid in source characterization. No subsurface soil samples were collected from Area 3. Surface and subsurface soil samples TC-SS/SB-17 were collected from an area which Mr. Ellzey told Black & Veatch field personnel contained dredge spoil. Sample locations are shown in Figure 4 and are described in Table 2.

4.3 Source Sampling Results

4.3.1 Source Organic Analytical Results

Analytical results from all surface soil samples collected from Areas 1, 2, and 3; except sample TC-SS-17, revealed elevated levels of toxaphene ranging in concentration from 890 µg/kg to 240,000 µg/kg. Results of analyses as prescribed by

the EPA Toxaphene Task Force are presented first with results of analyses according to CLP pesticides analyses in parentheses.

Toxaphene was detected in Area 3, the residential area, surface soil samples TC-SS-04 and TC-SS-05, at levels of 680 $\mu\text{g/kg}$ (2,200 $\mu\text{g/kg}$) and 2,200 $\mu\text{g/kg}$ (9,300C $\mu\text{g/kg}$), respectively. In addition, the following organic analytes were detected above the background concentration in Area 3: aldrin, dieldrin, 4,4'-DDE, 4,4'-DDT, methoxychlor, gamma-chlordane, and alpha-chlordane. The organic analytical results for Area 3 are presented in Table 4.

Toxaphene was detected in Area 1 surface soil samples at concentrations ranging from 23,000 $\mu\text{g/kg}$ (18,000C $\mu\text{g/kg}$) to 110,000 $\mu\text{g/kg}$ (240,000C $\mu\text{g/kg}$). The highest detected concentration of toxaphene in Area 1 surface soil was found in sample TC-SS-10, collected from the south berm of Area 1. Toxaphene was detected in Area 1 subsurface soil samples at concentrations ranging from 3,200J $\mu\text{g/kg}$ (100,000C $\mu\text{g/kg}$) to 330,000 $\mu\text{g/kg}$ (430,000C $\mu\text{g/kg}$). The highest detected concentration of toxaphene in Area 1 subsurface soil was found in sample TC-SB-06, collected from the central portion of the Area 1 impoundment. In addition, alpha-BHC and toluene were detected above background concentration in surface soils collected from Area 1. The organic analytical results for soil samples collected from Area 1 are presented in Tables 4 and 5.

Toxaphene was detected in one surface soil sample collected from Area 2, at a level of 6,300JN $\mu\text{g/kg}$ (11,000C $\mu\text{g/kg}$). Toxaphene was not detected in Area 2 surface soil sample TC-SS-15 according to the EPA Toxaphene Task Force protocol; however, it was detected in the CLP pesticide results at 890 $\mu\text{g/kg}$. Toxaphene was detected in Area 2 subsurface soil samples at concentrations ranging from 590J $\mu\text{g/kg}$ (5,300 $\mu\text{g/kg}$) to 56,000JN $\mu\text{g/kg}$ (23,000 $\mu\text{g/kg}$). In addition, heptachlor epoxide and gamma-chlordane were detected above background concentration in surface soils collected from Area 2. The organic analytical results for soil samples collected from Area 2 are presented in Tables 4 and 5.

Additionally, dimethyl phthalate was detected at an elevated concentration in offsite sample TC-SS-16 at 450 $\mu\text{g/kg}$.

Tab. .

[illegible]

Costo: 100.000.000 per sistema.

... but not detected above the sample-specific minimum quantitation levels (500).

STUDY 2: THE EFFECTS OF

1. **Category:** ☐ **Category:** ☐

J. C. GARDNER

The number's bound is the minimum quantile on level

U. Material was analyzed for total iron and

a. Estimated value is below the LCL.

... Temperature analyses performed by EPA - V&E by previously mentioned protocol and DSD by EPA - V&E by previously mentioned protocol.

Table 5
Summary of Organic Analytical Results
Subsurface Soils
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

1 10 0037

Sample Location		Background	Background							
Sample Identification Number	TC-SB-01	TC-SB-02	TC-SB-03	TC-SB-04	TC-SB-06	TC-SB-10	TC-SB-14	TC-SB-15	TC-SB-16	TC-SB-17
Date of Sample Collection	9/20/95	9/19/95	9/19/95	9/21/95	9/21/95	9/21/95	9/19/95	9/19/95	9/19/95	9/19/95
Extractable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Naphthalene	--	290J*	690	--	--	--	--	--	--	--
2-Methylnaphthalene	--	470J*	700	--	--	--	--	--	--	--
Acenaphthylene	72J*	500U	240J*	--	--	--	--	--	--	--
Acenaphthene	--	500U	250J*	--	--	--	--	--	--	--
Dibenzofuran	--	140J*	220J*	--	--	--	--	--	--	--
Phenanthrene	--	300J*	720	--	--	--	--	--	--	--
Anthracene	--	74J*	500J*	--	--	--	--	--	--	--
Carbazole	--	500U	140J*	--	--	--	--	--	--	--
Fluoranthene	73J*	200J*	3,800	--	--	--	--	--	--	--
Pyrene	91J*	200J*	3,200	--	--	--	--	--	--	--
Benzofluoranthene	--	500U	3,000	--	--	--	--	--	--	--
Chrysene	--	340J*	2,500	--	--	--	--	--	--	--
Benzofluoranthene (not B or K)	--	860J*	8,000	--	--	--	--	--	--	--
Benzofluoranthene	--	300J*	3,100	--	--	--	--	--	--	--
Indene (1,2,3-cd) pyrene	--	260J*	1,800	--	--	--	--	--	--	--
Dibenzofluoranthene	--	86J*	580	--	--	--	--	--	--	--
Benzofluoranthene	--	360J*	1,900	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Dieldrin	330N	5.0U	4.5U	--	--	--	--	--	--	--
Heptachlor epoxide	47	5.7	6.0U	--	--	--	71	160	--	--
Gamma-Chlordane /2	--	2.4U	2.2U	--	--	--	17	--	--	--
Toxaphene	10,000	240U	330U	430,000C	380,000C	100,000C	4,500	6,300	--	23,000C
Toxaphene***	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Toxaphene	7,100	540U	310U	330,000	200,000	3,200J	2,200JN	590J	--	58,000
Purgeable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Benzene	--	15U	14U	4J*	--	--	--	--	--	--
Chloroform	--	15U	14U	--	2J*	--	--	--	--	--
Toluene	3J	8J*	8J	18	18J	--	--	--	--	--
Carbon Disulfide	--	2J*	14U	--	--	--	--	--	8J*	7J*
Misc. Purgeable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Camphene	--	--	--	10JN	10JN	--	--	--	--	--
Methyl (methyl) Benzene	--	--	--	--	8JN	--	--	--	--	--
Unidentified Compounds/8	200J/2	--	--	--	--	--	--	--	--	30J/1
Misc. Extractable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Indole	--	--	300JN	--	--	--	--	--	--	--
Biphenyl	--	--	--	1,000JN	--	--	--	--	--	--
1-Methylnaphthalene	--	--	500JN	--	--	--	--	--	--	--
Dimethylnaphthalene (4 isomers)	--	--	1,000JN	--	--	--	--	--	--	--
Opheyl Ether	--	--	--	1,000JN	--	--	--	--	--	--
Decahydroanthracene	--	--	--	1,000JN	--	--	--	--	--	--
Naphthalene carboxaldehyde	--	--	200JN	--	--	--	--	--	--	--
Methylbenzofuran	--	--	300JN	--	--	--	--	--	--	--
Fluorenone	--	--	200JN	--	--	--	--	--	--	--
Methylanthracene (5 isomers)	--	--	2,000JN	--	--	--	--	--	--	--
Dimethylphenanthrene (2 isomers)	--	--	600JN	--	--	--	--	--	--	--
Cyclopentaphenanthrene	--	--	800JN	--	--	--	--	--	--	--
Benzofluorene	--	--	500JN	--	--	--	--	--	--	--
Methylpyrene	--	--	400JN	--	--	--	--	--	--	--
Benzanthracene	--	--	300JN	--	--	--	--	--	--	--
Methylchrysene	--	--	300JN	--	--	--	--	--	--	--
Benzofluoranthene (not B or K)	--	--	1,000JN	--	--	--	--	--	--	--
Benzaldehyde	--	--	--	400JN	--	--	--	--	--	--
Borneol	--	--	--	800JN	800JN	--	--	--	--	--
Phellandrene	--	--	--	400JN	--	--	--	--	--	--
Octahydrodimethyl(methyl)ethyl-phenanthrene carboxylic acid	--	--	--	--	--	--	300JN	2,000JN	--	--
Unidentified Compounds/8	--	2,000J/2	8,000J/3	40,000J/19	20,000J/21	40,000J/35	4,000J/2	20,000J/12	9,000J/8	80,000J/31

Shading indicates a value of three times background or above detection background detection limit if not detected.

* - Estimated value is below the SOL.

µg/kg - Micrograms per kilogram.

-- Indicates the material was analyzed for but not detected above the sample-specific minimum quantitation limits (SOL).

C - Confirmed by GCMS

J - Estimated value.

N - Presumptive evidence of presence of material

U - Material was analyzed for but not detected. The number shown is the minimum quantitation limit.

*** - Toxaphene analyses performed by EPA - ESO per method determined by EPA Toxaphene Task Force June 4, 1993.

4.3.2 Source Inorganic Analytical Results

Numerous inorganic constituents, including aluminum, beryllium, chromium, copper, magnesium, manganese, mercury, nickel, potassium, silver, sodium, vanadium, and zinc were detected in surface and subsurface soil samples collected from Areas 1, 2, and 3. Summaries of soil sampling inorganic analytical results are presented in Tables 6 and 7.

4.4 Source Conclusions

Three source areas have been evaluated for this investigation: Dredge Spoil Area 1 (Area 1), Dredge Spoil Area 2 (Area 2), and Dredge Spoil Area 3 (Area 3). Toxaphene-contaminated dredge spoil is known to have been deposited at Area 1. Although available file material does not confirm toxaphene-contaminated dredge spoil deposition at Areas 2 and 3, analyses of surface soil samples collected from these areas during the ESI revealed elevated levels of toxaphene. Area 2 is potentially a residential area, and Area 3 is located at a residential area. The potential number of residents at these areas being exposed to toxaphene-contaminated materials is a primary concern for this site.

Table 6
Summary of Inorganic Analytical Results
Surface Soil Samples
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	TC-SS-01	Background	TC-SS-02	Background	TC-SS-03	TC-SS-04	TC-SS-05	TC-SS-06	TC-SS-07	TC-SS-08	TC-SS-09	TC-SS-10	DUP	TC-SS-14	TC-SS-15	DUP	TC-SS-16	TC-SS-17
Date of Sample Collection	9/20/95	9/18/95	9/18/95	9/18/95	9/18/95	9/20/95	9/20/95	9/20/95	9/20/95	9/21/95	9/21/95	9/21/95	8/21/95	9/18/95	9/18/95	8/18/95	9/18/95	9/18/95
Urea	1,500	1,800	2U	8.2	27	11	16	31	34	18	12	12	17,000	20,000	19,000	19,000	8,600	19,000
Asenic	11	8.2	2U	8.2	27	11	16	31	34	18	12	12	17,000	20,000	19,000	19,000	8,600	19,000
Barium	11	8.2	2U	8.2	27	11	16	31	34	18	12	12	17,000	20,000	19,000	19,000	8,600	19,000
Beryllium	11	8.2	2U	8.2	27	11	16	31	34	18	12	12	17,000	20,000	19,000	19,000	8,600	19,000
Calcium	1,500	1,800	2U	8.2	27	11	16	31	34	18	12	12	17,000	20,000	19,000	19,000	8,600	19,000
Chromium	1,500	1,800	2U	8.2	27	11	16	31	34	18	12	12	17,000	20,000	19,000	19,000	8,600	19,000
Iron	1,500	1,800	2U	8.2	27	11	16	31	34	18	12	12	17,000	20,000	19,000	19,000	8,600	19,000
Lead	7.3	4.3	4.1	4.1	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Magnesium	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410
Manganese	8.2	34	34	34	66	66	66	66	66	66	66	66	66	66	66	66	66	66
Mercury	0.06U	0.06U	0.06U	0.06U	0.07U	0.07U	0.07U	0.07U	0.07U	0.07U	0.07U	0.07U	0.07U	0.07U	0.07U	0.07U	0.07U	0.07U
Nickel	11	10U	10U	10U	3U	3U	3U	3U	3U	3U	3U	3U	3U	3U	3U	3U	3U	3U
Potassium	87J	100J	100J	100J	900	900	900	900	900	900	900	900	900	900	900	900	900	900
Silver	5.6	0.75U	0.75U	0.75U	0.81U	0.81U	0.81U	0.81U	0.81U	0.81U	0.81U	0.81U	0.81U	0.81U	0.81U	0.81U	0.81U	0.81U
Sodium	1,500	1,800	2U	8.2	27	11	16	31	34	18	12	12	17,000	20,000	19,000	19,000	8,600	19,000
Vanadium	1,500	1,800	2U	8.2	27	11	16	31	34	18	12	12	17,000	20,000	19,000	19,000	8,600	19,000
Zinc	1,500	1,800	2U	8.2	27	11	16	31	34	18	12	12	17,000	20,000	19,000	19,000	8,600	19,000

Shading indicates a value greater than or equal to background concentration.

mg/kg - Milligrams per kilogram.

... indicates the sample was analyzed, but the specific analysis was not detected above the sample-specific maximum quantization limits (SOL).

U - Material was analyzed for but not detected. The number shown is the minimum quantization limit.

J - Estimated value.

Table 7
Summary of Inorganic Analytical Results
Subsurface Soil Samples
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	TC-SB-01	Background	TC-SB-02	Background	TC-SB-03	TC-SB-06	TC-SB-08	TC-SB-10	TC-SB-14	TC-SB-15	TC-SB-16	TC-SB-17
Sample Identification Number	TC-SB-01	TC-SB-02	TC-SB-03	TC-SB-06	TC-SB-08	TC-SB-10	TC-SB-14	TC-SB-15	TC-SB-16	TC-SB-17	TC-SB-16	TC-SB-17
Date of Sample Collection	9/20/95	9/19/95	9/19/95	9/21/95	9/21/95	9/21/95	9/21/95	9/21/95	9/19/95	9/19/95	9/19/95	9/19/95
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	1,500	6,600	4,400	12,000	14,000	7,500	23,000	18,000	23,000	18,000	23,000	18,000
Antimony	-	8UJ	6UJ	-	-	-	-	-	-	-	-	-
Arsenic	-	5.7	8.2	13	8.7	13	14	14	14	14	19	13
Barium	11	200	69	20	29	28	29	24	27	24	27	24
Calcium	2,100	9,600	6,500	6,800	4,300	17,000	3,000	4,500	2,700	4,500	2,700	4,700
Chromium	-	5.8	8.8	24	27	15	37	39	38	39	38	30
Copper	-	30U	40U	45	-	-	-	-	-	-	-	-
Iron	1,200	16,000	11,000	23,000	17,000	17,000	26,000	27,000	23,000	27,000	23,000	23,000
Lead	8.6	64	88	29	26	13	22	20	20	20	20	19
Magnesium	-	1,000	1,100	3,200	3,200	2,900	6,600	7,400	4,700	7,400	4,700	5,800
Manganese	13	120	190	320	210	150	170	350	81	350	81	240
Mercury	-	0.07U	0.12	0.21	0.18	-	-	-	-	-	-	-
Nickel	-	8.7J	7.1J	8.3J	7.9J	5.5J	8.6J	8.7J	10J	8.7J	10J	10J
Potassium	71	810	340	1,500	1,700	1,700	3,800	3,800	3,200	3,800	3,200	2,900
Sodium	-	380U	160U	3,100	2,200	810	19,000	22,000	6,000	22,000	6,000	15,000
Vanadium	-	18	14	37	37	24	59	58	75	58	75	60
Zinc	-	30U	84	-	53	-	-	-	-	-	-	-

Shading indicates a value greater than or equal to background concentration.

mg/kg - Milligrams per kilogram.

-- - Indicates the sample was analyzed, but the specific analyte was not detected above the sample-specific minimum quantitation limits (SQL).

U - Material was analyzed for but not detected. The number shown is the minimum quantitation limit.

J - Estimated value.

5.0 Groundwater Pathway

5.1 Hydrogeologic Setting

Glynn County is located in coastal Georgia, in the Sea Island section of the Atlantic Coastal Plain Physiographic Province (Ref. 32, p. D6, Figure 2). Topography in Glynn County consists of relatively flat land, 0 to 15 feet above mean sea level (msl), surrounded by tidal marshes, creeks, and rivers (Ref. 1). The Hercules Terry Creek Dredge Spoil Area is located on the eastern side of the Brunswick Peninsula. It is bordered on the east by a tidal marsh which is periodically submerged and on the west by Dupree Creek (Ref. 1). The climate of Glynn County is warm and humid with hot summers, and cool, damp winters. Precipitation in the Brunswick area averages 52 inches per year with a mean annual lake pan evaporation of 45 inches, yielding an annual net precipitation of 7 inches (Ref. 3, pp. 43, 63). The 2-year, 24-hour rainfall is documented to be 5.0 inches (Ref. 4, p. 95).

Two aquifer systems exist in the study area: the unconfined surficial (water table) aquifer, and the Upper Floridan Aquifer (principal artesian) (Ref. 32, pp. D15-D18, D21, Table 3). Strata of Miocene Age between the surficial aquifer and the Floridan Aquifer yield water to wells at some locations in Glynn County, and could be considered an aquifer, however, these strata may restrict the movement of water at other locations (Ref. 33, p. D9).

Surface soil at the site belongs to the Bohicket-Capers Soil Association, which consists of level soils that are clayey throughout and occur in tidal marshes (Ref. 2, General Soil Map). The soil type beneath the Hercules Terry Creek Dredge Spoil Area is specifically listed as Bohicket-Capers (Ref. 2, Sheet 32). This soil is very level, very poorly drained, and exhibits low alkalinity, low natural fertility, and low permeability (Ref. 2, pp. 8, 9, 13, 16, 18).

The surficial aquifer in Glynn County comprises recent and Pleistocene Series sediments (Ref. 34, pp. E22, E23). These sediments consist of very fine to fine grained, well rounded and well sorted sand (Refs. 32, p. D18; 34, p. E9). As depth increases, the fine sand grades into coarse sand and becomes fossiliferous (Ref. 34, p. E9). The base of the Pleistocene sediments is represented by a hard, calcareous to siliceous gravelly sand layer which has been found at a depth of 42 feet. However, the depth varies across Glynn County (Ref. 34, p. E9). Near the Hercules Terry Creek Dredge Spoil Area, the thickness of the Pleistocene deposits is observed to be

between 40 to 50 feet (Ref. 35, Figures 1, 2). Recharge to the surficial aquifer occurs by infiltration of precipitation directly through surface soil (Refs. 32, p. D18; 34, p. E22). Wells completed in this aquifer have been used to water lawns and gardens, but are not utilized for potable supplies (Refs. 33, p. D9; 34, p. E22; 36; 37; 38).

Aquifer tests performed in wells screened in the surficial aquifer revealed transmissivities ranging from 960 to 1,300 square feet per day (ft^2/day) (Ref. 33, p. D8, Table 1). Shallow wells (wells with an average total depth of 36 feet below land surface) were installed at a landfill in Brunswick located less than 1 mile west of the Hercules Terry Creek Dredge Spoil Area 1, and yielded hydraulic conductivity values ranging from 1.1×10^{-3} to 4.8×10^{-3} centimeters per second (cm/sec) (Ref. 39, p. 3-5).

Underlying the Pleistocene sediments is a series of feldspathic sand, gravel, thin limestone, and thin clay beds (Ref. 34, Plate 1). The age of this series is unknown, but has been estimated to be Pliocene (Ref. 34, pp. D10, D11). The thickness of this series is estimated to be 120 to 140 feet (Refs. 33, pp. D7, D9; 28, p. E10). Wells completed in this zone are tapped primarily for yard irrigation, and are not utilized for potable supply (Refs. 33, p. D7; 36; 37; 38). An aquifer test performed on the Pliocene beds resulted in a transmissivity value of $6,700 \text{ ft}^2/\text{day}$ (Ref. 33, p. D8). Aquifer tests performed at the Hercules landfill in southern Brunswick resulted in hydraulic conductivity values ranging from 9.65×10^{-3} to $1.1 \times 10^{-2} \text{ cm}/\text{sec}$ (Ref. 39, p. 3-5). Tests performed at this landfill were reported to be consistent with other tests previously conducted in this area (Ref. 39, p. 3-5).

The upper 200 feet of strata in the Brunswick area which contain the Pleistocene sediments and the Pliocene beds are water-bearing but are not utilized for potable use. Many private wells lie northwest of the Hercules Terry Creek Dredge Spoil Area but are drilled to a depth of greater than 200 feet below land surface. These deep private wells are typically cased from anywhere between 85 and 200 feet bls then further drilled and unscreened to depths averaging 800 feet bls. Between 195 and 210 feet bls in Brunswick, green marl and clay are encountered which are indicators of the top of the Miocene Hawthorn Formation. Wells which utilize the water table or shallow aquifer (less than 200 feet bls) are usually dug wells which are used for private, non-agricultural irrigation systems or for automobile washing (Refs. 36; 37; 38).

Below the Pliocene Series are Miocene aged Strata, of which the Hawthorn

Formation is a member. Immediately beneath the Pliocene Series lies a Miocene Aged clay layer, which is dark brown, granular, poorly consolidated, and phosphatic. This clay layer is locally underlain by coarse sand and fine gravel. The Hawthorn Formation underlies the uppermost Miocene clay layer and consists of clayey silt interbedded with fossiliferous phosphatic sand. Beneath the Hawthorn Formation lies a series of sand layers interspersed with cherty limestone (Ref. 33, p. D9). The total thickness of Miocene Strata in Glynn County is approximately 400 feet (Refs. 32, Plates 3, 5; 33, p. D9). The Hawthorn Formation and overlying Miocene strata form an effective aquiclude, restricting the vertical movement of groundwater in the area (Ref. 33, p. D10). Vertical hydraulic conductivity of the upper confining unit in Brunswick was calculated to range from 1.7×10^{-8} to 3.9×10^{-4} cm/sec (Ref. 32, p. D28).

The Upper Floridan Aquifer is the principal source of groundwater in Glynn County (Refs. 32, p. D21; 33, pp. D11-D13). The Upper Floridan Aquifer is composed of the Oligocene Series, the Ocala Limestone, and equivalent strata of late Eocene Age (Refs. 32, p. D21; 33, Plate 1). It is divided into two permeable zones: the upper and lower water-bearing zones (Ref. 32, p. D17). The upper water-bearing zone includes the top 75 to 150 feet of the Ocala Limestone and contributes about 70 percent of water to wells that tap both zones. The lower water-bearing zone ranges in thickness from 15 to 110 feet and includes the Basal Ocala and the uppermost part of Middle Eocene strata. The lower water-bearing zone becomes more dense and less permeable than the upper water-bearing zone and contributes about 30 percent of water to wells that tap both zones. Water supply wells generally do not tap the units beneath the Upper Floridan Aquifer in Glynn County (Ref. 32, p. D21). The Upper Floridan Aquifer is a very prolific source of groundwater due to cavernous zones produced by chemical interaction of limestone with groundwater (Ref. 32, pp. D1, D2).

The Oligocene Series ranges from 20 to 80 feet in thickness in Glynn County (Ref. 33, p. D11). The Oligocene Series is composed of limestone which is yellowish-gray, phosphatic, sandy, fossiliferous and slightly dolomitic (Ref. 33, Plate 1). The surface of the Oligocene Limestone ranges from 480 to 580 feet bls (Ref. 33, Plate 2). Although the Oligocene Series is considered part of the Upper Floridan Aquifer, most wells in Glynn County are drilled through this interval into the underlying Ocala Limestone (Ref. 33, p. D11).

The Ocala Limestone is approximately 350 to 400 feet thick in Glynn County (Ref.

33, p. D12). The Ocala Limestone is a white to gray fossiliferous limestone with zones of hard, dense, recrystallized limestone (Ref. 34, Plate 1). The surface of the Ocala Limestone ranges from 595 to 750 feet bls (Ref. 33, p. D12). The Ocala Limestone is extremely permeable due to the development of solution cavities along bedding planes, joints, fractures, and other zones of weakness (Ref. 32, p. D21).

Hydraulic conductivity and transmissivity of the Upper Floridan Aquifer in Glynn County are estimated to be very high (Ref. 32, p. D26). Caliper, sonic borehole televiwer, and borehole television traverses performed in a test well near Brunswick showed that extensive caverns exist throughout the Floridan lower aquifer (Ref. 32, p. D26). Cavernous zones are proven areas of high permeability.

5.2 Groundwater Pathway Targets

Potable water within the 4-mile radius of the site is supplied by the City of Brunswick Water Department, and community and private wells. The Brunswick Water Department provides potable water to 10,734 connections with nine wells, four of which are located within four miles of the site (Refs. 1; 5, Vol. 1, pp. 1a, 23; 40). The Brunswick Water Department wells are approximately 750 to 1,000 feet bls and are completed in the Upper Floridan Aquifer (Ref. 40). The closest Brunswick Water Department well is located approximately 4,000 feet northwest of Area 1 (Ref. 1; 40). The Terry Creek Trailer Park, located at Area 3, operates one community well which serves approximately nine connections, or 23 persons (Ref. 5, Vol. 1, pp. 1a; 19, p. 4).

Private well usage in the study area was estimated by a house count on a topographic map, assuming a population multiplier for Glynn County of 2.57 persons per household (Refs. 1; 41). There are approximately 600 private wells or 1,542 people located within the study area. The following numbers of people utilize private wells: 0 - 0.25 mile, 85 persons; 0.25 - 0.5 mile, 0 persons; 0.5 - 1 mile, 0 persons; 1 - 2 miles, 5 persons; 2 - 3 miles, 180 persons; and 3 - 4 miles, 1,272 persons (Refs. 1; 41). The approximate number of residents served by private wells or municipal well systems within the study area is 13,825 distributed as follows: 0 - 0.25 mile, 108 persons; 0.25 - 0.5 mile, 0 persons; 0.5 - 1 mile, 3,065 persons; 1 - 2 miles, 9,200 persons; 2 - 3 miles, 180 persons; and 3-4 miles, 1,272 persons (Refs. 1; 42). The nearest private well is located in the residential trailer park located at Area 3 (Ref. 1). The total wells and populations served are distributed as indicated in Table 8.

Table 8
Radial Summary of Groundwater Users
Hercules Terry Creek Dredge Spoil Area
Brunswick, Glynn County, Georgia

Radial Distance (miles)	Private Well Population		Public Well Population			Total Groundwater Users ²
	Households	Private Well Users ¹	Wells/Total Number of Connections	Municipal or Community Well Systems	Public Well Users	
0.00 - 0.25	33	85	1/9	Terry Creek Trailer Park	23	108
0.25 - 0.50	0	0	0	--	0	0
0.50 - 1.00	0	0	1/1,193	Goodyear Park	3,065	3,065
1.00 - 2.00	2	5	3/3,579	Brunswick Villa Perry Park, & Howard Coffin Park	9,195	9,200
2.00 - 3.00	70	180	0	--	0	180
3.00 - 4.00	495	1,272	0	--	0	1,272
Totals	600	1,542	5/4,781	--	12,283	13,825

Notes:

- 1 The number of users is determined by multiplying the number of households or connections by 2.57 persons per household (Ref. 41).
- 2 Total groundwater users for a specific radial distance is determined by adding the number of private well users to the number of public or community well users.

5.3 Groundwater Pathway Sample Locations

Groundwater sample TC-PW-01 was collected from a privately owned well located at [REDACTED] and TC-PW-02 was collected at [REDACTED]. Groundwater sample TC-CW-01 was collected from a community well located in Terry Creek Trailer Park (Ref. 5). Groundwater samples were collected to determine the absence or presence of toxaphene in a residential area. Groundwater sampling locations are shown on Figure 3 and are described in Table 2.

5.4 Groundwater Pathway Analytical Results

Toxaphene was not detected in analytical results of groundwater samples collected from the privately owned wells or the Terry Creek Trailer Park community well. Barium was detected in TC-CW-01, TC-PW-01, and TC-PW-02, and mercury was detected in TC-CW-01 and TC-PW-02. No organic constituents were detected. Summaries of groundwater analytical results are presented in Table 9.

1 10 6040

Table 9
Summary of Inorganic Analytical Results for
Groundwater Samples

Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	Preservative	Offsite	Offsite	Offsite
Sample Identification Number	TC-PB-01	TC-CW-01	TC-PW-01	TC-PW-02
Date of Sample Collection	9/22/95	9/22/95	9/20/95	9/21/95
Units	µg/L	µg/L	µg/L	µg/L
Aluminum	30UJ	--	--	--
Antimony	20UJ	--	--	--
Arsenic	3UJ	--	--	--
Barium	2UJ	44J	44J	27J
Beryllium	1UJ	--	--	--
Cadmium	2UJ	--	--	--
Calcium	70UJ	40,000J	38,000J	37,000J
Chromium	2UJ	--	--	--
Cobalt	3UJ	--	--	--
Copper	4UJ	--	--	--
Cyanide	10UJ	--	--	--
Iron	20UJ	450J	--	500J
Lead	2UJ	--	--	--
Magnesium	100UJ	23,000J	22,000J	21,000J
Manganese	1UJ	--	--	--
Mercury	0.2UJ	0.41J	--	0.21J
Nickel	7UJ	--	--	--
Potassium	140J	1,700J	1,700J	1,800J
Selenium	3UJ	--	--	--
Silver	3UJ	--	--	--
Sodium	610UJ	15,000J	15,000J	20,000J
Thallium	3UJ	--	--	--
Vanadium	3UJ	--	--	--
Zinc	7UJ	--	--	--

µg/L - Micrograms per liter.

-- Indicates the sample was analyzed, but the specific analyte was not detected
minimum quantitation limits (SQL).

U - Sample was analyzed but analyte was not detected. The number shown is the quantitation limit.

J - Estimated value.

PB - Preservative Blank

PW - Private Well

CW - Community Well

5.5 Groundwater Pathway Conclusions

Toxaphene was not detected in the two nearby private wells or the trailer park community well. Although the inorganic constituents barium and mercury were detected in groundwater samples; they are not believed attributable to contaminated sediments deposited at the Hercules Terry Creek Dredge Spoil Area. Due to the lack of actual contamination in a potable well and a relatively low target population, the groundwater pathway is not a pathway of primary concern for this site.

6.0 Surface Water Pathway

6.1 Hydrologic Setting

Areas 1, 2, and 3 are situated on coastal estuarine marshlands and are completely surrounded by wetlands and creeks (Refs. 1; 43). Runoff from Area 1 enters Dupree Creek via three drainage weirs located at the north and west sides of the impoundment. Dupree Creek flows into Terry Creek approximately 800 feet below Hercules, Inc.'s 001 NPDES outfall. Runoff from Areas 2 and 3 flows into Terry Creek which flows east for approximately 6,400 feet into the Back River, which then flows approximately 10,500 feet into St. Simons Sound. St. Simons Sound empties into the Atlantic Ocean at approximately 6.5 stream miles from the site (Ref. 1). Dupree Creek, Terry Creek, and the Back River are all tidally influenced; therefore, stream flow rates for these water bodies are highly variable (Refs. 1; 31, pp. 1, 6). The site is located within a 100-year floodplain (Ref. 44).

6.2 Surface Water Pathway Targets

There are no known surface water intakes located along the 15-mile pathway. Recreational fishing occurs in Dupree and Terry creeks and the Back River. Although, commercial fishing does occur in St. Simons Sound, comprehensive marine investigations of commercial fishery resources of Terry Creek, Dupree Creek or the Back River have not been identified (Refs. 45; 46). Commercial landings for the Altamaha River and St. Simons Sound for 1983 totaled 84,813 pounds with blue crabs accounting for 69,741 pounds. The recreational harvest rate is 42 pounds per acre (lbs/acre) with a harvestable standing crop for the river estimated at 122 lbs/acre. The National Marine Fisheries Service landings data indicate that 294,379 pounds of shellfish were commercially harvested from the St. Simons Sound area during 1987. Blue crab comprised approximately 294,196 pounds harvested, while conch made up the remainder of the landings (Ref. 46).

Dupree Creek is a habitat for the federally-endangered West Indian manatee (*Trichechus manatus*) during the spring and summer (Refs. 43; 47). The West Indian manatee, as well as other Federally-endangered/threatened species, including the Wood stork (*mycteria americana*), Loggerhead sea turtle (*Caretta caretta*), and the Ridley sea turtle (*Lepidochelys kempi*) are also located in Terry Creek, the Back River, and St. Simons Sound (Ref. 47). The Short-nose sturgeon (*Acipenser brevirostrum*) and the Green sea turtle (*Chelonia mydas*) are also known to be located in St. Simons Sound (Ref. 47). Other Federally-endangered or threatened species

6.4 Surface Water Pathway Analytical Results

6.4.1 Surface Water/Sediment Organic Analytical Results

Elevated concentrations of toxaphene were detected in analytical results of sediment samples collected from Dupree and Terry creeks; from the confluence of Dupree and Terry creeks; from the Hercules, Inc., NPDES outfall drainage ditch; and from the Back River. Toxaphene was detected in TC-SD-01 at 17,000 $\mu\text{g/kg}$ (62,000 $\mu\text{g/kg}$), collected South of Torras Causeway on Terry Creek. Toxaphene was detected at an elevated concentration of 15,000 $\mu\text{g/kg}$ (34,000 $\mu\text{g/kg}$) in TC-SD-11, collected from the Hercules, Inc., NPDES outfall drainage ditch. Toxaphene was detected in samples TC-SD-04, TC-SD-05, and TC-SD-08 collected from Dupree and Terry Creeks in the vicinity of Area 1, at levels of 2,500J $\mu\text{g/kg}$ (3,100 $\mu\text{g/kg}$), 8,500 $\mu\text{g/kg}$ (30,000C $\mu\text{g/kg}$), and 29,000 $\mu\text{g/kg}$ (2,100 $\mu\text{g/kg}$), respectively. According to the EPA Toxaphene Task Force Protocol, toxaphene was not detected in samples TC-SD-06, located on Dupree Creek, and TC-SD-07, located at the confluence of Dupree and Terry Creeks. However, toxaphene was detected in these samples according to the CLP pesticide results, at 1,500 $\mu\text{g/kg}$ and 610 $\mu\text{g/kg}$, respectively. The extractable organic compounds 3-and/or 4-methylphenol, fluoranthene, and pyrene were detected in sample TC-SD-11, located at the Hercules, Inc., NPDES Permit 001 discharge point, at 1,200 $\mu\text{g/kg}$, 1,100 $\mu\text{g/kg}$, and 1,200 $\mu\text{g/kg}$, respectively. Heptachlor epoxide was detected in sample TC-SD-10, located at the confluence of the Back River and Terry Creek, at 28 $\mu\text{g/kg}$. Sample TC-SD-06 contained 4,4'-DDE at an elevated concentration of 100 $\mu\text{g/kg}$. Carbon Disulfide was detected in samples TC-SD-05 and TC-SD-08, located north and south of Area 1, at 29 $\mu\text{g/kg}$ and 46 $\mu\text{g/kg}$, respectively. Organic constituents other than toxaphene are not believed to be attributable to discharge effluent from Hercules, Inc. or the subsequently contaminated sediments deposited at the Hercules Terry Creek Dredge Spoil Area. A summary of sediment organic analytical results is presented in Table 10. Sample locations are illustrated on Figures 3, 4, and 5.

Toxaphene was not detected in surface water samples using CLP analyses. Toxaphene was not analyzed for using the EPA Toxaphene Task Force method. Delta-BHC, endrin, 4,4-DDD, and alpha chlordane were detected at elevated concentrations in the surface water samples. A summary of surface water organic analytical results is included in Table 11.

Table 10

Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

[illegible]

Shading indicates a value of three times background or above.

... Mikroorganismen der Umwelt.

ug/kg - Micrograms per kilogram.

... - Indicates the material

C. Confirmed by GLC

J. L. Estimated value.

2. Δ = Amount of increase of material

N = Presumptive evidence of presence or invasion.

U - POLYMER WAS

NA - Not analyzed

Table 11
Summary of Organic Analytical Results
Surface Water Samples
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	TC-SW-01	Background	TC-SW-02	Background	TC-SW-03	Background	TC-SW-04	TC-SW-05	TC-SW-06	TC-SW-07	TC-SW-08	DUP	TC-SW-09	TC-SW-10	TC-SW-11	Background
Date of Sample Collection	8/21/96	9/20/95	9/20/95	9/20/95	9/20/95	9/20/95	9/21/95	9/20/95	9/22/95	9/22/95	9/22/95	9/22/95	9/22/95	9/22/95	9/22/95	9/20/95
Miscellaneous Extractable Organics	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Diethyltoluamide																
Tetramethylphenanthrene																
Biphenyl																
Phenoxypheol																
Diphenyl ether																
Octachlorobenzene acid							20JN									
Pesticides/PCBs	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Delta-BHC	-	0.060U	0.060U	0.060U	0.060U	0.060U	0.092	-	0.093	0.52	-	-	-	-	-	0.050U
Endrin	-	0.10U	0.10U	0.10U	0.10U	0.10U	-	-	-	-	-	-	-	-	-	0.10U
4,4'-DDD	-	0.10U	0.10U	0.10U	0.10U	0.10U	0.062JN	-	0.089J*	0.59	0.11	0.19	0.87J*	-	0.26N	0.10U
4,4'-DDT	-	0.10U	0.10U	0.10U	0.10U	0.10U	-	-	-	-	0.13	-	0.074J*	-	-	0.10U
Alpha-Chlordane /2	0.030J*	0.050U	0.050U	0.050U	0.050U	0.050U	-	-	-	0.36	0.09JN	0.10	0.062N	0.047JN	0.18	0.050U
Pesticides Organics	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Carbon Disulfide	-	10U	10U	10U	10U	10U	-	-	-	-	-	-	-	-	-	10U
Chloroform	3J*	17J	17J	10U	10U	10U	7J*	14J	8J*	18J	12J	12J	7J*	4J*	43J	10U
Carbon Tetrachloride	4J	41J	41J	10U	10U	10U	10J	30J	14J	56J	34J	34J	17J	9J*	140J	10U
Benzene	-	10U	10U	10U	10U	10U	-	-	-	-	-	-	-	-	-	10U
Toluene	-	10U	10U	1J*	1J*	1J*	-	-	-	-	-	-	-	-	-	10U
Ethyl Benzene	-	10U	10U	10U	10U	10U	-	-	-	-	-	-	-	-	-	10U
Unidentified Compounds/g																

Shading indicates a value of three times background or above.

µg/L - Micrograms per liter.

- - - Indicates the material was analyzed for but not detected above the sample-specific minimum quantitation limits (SQL).

C - Confirmed by GC/MS

J - Estimated value.

* - Estimated value is below the SQL.

N - Presumptive evidence of presence of material

U - Material was analyzed for but not detected. The number shown is the minimum quantitation limit.

Analytical results from wetland sediment sample TC-WSD-01 revealed toxaphene at an elevated level of 31,000 µg/kg (46,000C µg/kg). Toxaphene was not detected in sample TC-WSD-02 according to the EPA Toxaphene Task Force, however was detected in the CLP pesticide results at 1,200 µg/kg. Heptachlor epoxide was detected in sample TC-WSD-01 at 390 µg/kg. Summaries of the surface water and sediment sampling analytical results are presented in Tables 10 and 11, respectively. A summary of wetland sediment analytical results is presented in Table 12.

6.4.2 Surface Water/Sediment Inorganic Analytical Results

The inorganic constituents copper, mercury, and zinc were detected in sediment samples at elevated concentrations, and copper and lead were detected in surface water samples at elevated concentrations. However, these inorganic analytes are not believed attributable to contaminated sediments deposited at the Hercules Terry Creek Dredge Spoil Area. No inorganic constituents were detected at elevated levels wetland sediment samples collected from Dupree and Terry creeks. A summary of the sediment, surface water, and wetland sediment sampling inorganic analytical results are presented in Tables 13, 14, and 15.

6.5 Surface Water Pathway Conclusions

Analytical results of sediment samples collected from Dupree and Terry creeks, the confluence of Dupree and Terry creeks, the Hercules, Inc., NPDES outfall drainage ditch, and the Back River revealed elevated levels of toxaphene. Toxaphene has also been detected in surface soil samples collected from Areas 1, 2, and 3 and in subsurface soil samples collected from Areas 1 and 2. Dupree and Terry Creeks and the Back River are known fisheries and habitats for several federally-endangered species. The surface water migration pathway is a pathway of primary concern for the site.

Table 12
Summary of Organic Analytical Results for
Wetland Sediment Samples
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	Background	Offsite	Offsite	Offsite	Offsite
Sample Identification Number	TC-WSD-03	TC-WSD-01	TC-WSD-02	TC-WSD-04	TC-WSD-05
Date of Sample Collection	9/22/95	9/20/95	9/21/95	9/21/95	9/19/95
Extractable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Benzo(GH) perylene	1100U	100J*	--	--	--
Miscellaneous Extractable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Octahydrodimethyl(methylethyl)-phenanthrenecarboxylic acid		700JN	300JN		
Unidentified Compounds/#	20,000J/10	8,000J/6	20,000J/9	3,000J/2	10,000J/5
Pesticides/PCBs	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Dieldrin	11U	1,200N	--	--	--
Heptachlor epoxide	5.9U	390	--	--	--
4,4' DDE	11U	--	--	--	--
Toxaphene	200J*	45,000C	1,200	320J*	160J*
Toxaphene***	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Toxaphene	11,000U	31,000	--	--	--
Purgeable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Carbon Disulfide	34U	--	--	6J*	5J*
Miscellaneous Purgeable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Methylcyclohexadiene		90JN			
Camphene		50JN			
Pinene		30JN			

Shading indicates a value of three times background or above.

µg/kg - Micrograms per kilogram.

-- - Indicates the material was analyzed for but not detected.

C - Confirmed by GCMS

J - Estimated value.

* - Estimated value is below the SQL.

N - Presumptive evidence of presence of material

U - Material was analyzed for but not detected. The number shown is the minimum quantitation limit.

*** - Toxaphene analyses performed by EPA - ESD per method determined by EPA Toxaphene Task Force June 4, 1993.

Table 13
Summary of Inorganic Analytical Results for
Sediment Samples
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	TC-SD-01	Background	TC-SD-02	Background	TC-SD-03	TC-SD-04	TC-SD-05	TC-SD-06	TC-SD-07	TC-SD-08	DUP	TC-SD-09	TC-SD-10	TC-SD-11	Background
Sample Identification Number	TC-SD-01	TC-SD-02	TC-SD-03	TC-SD-04	TC-SD-05	TC-SD-06	TC-SD-07	TC-SD-08	TC-SD-09	TC-SD-10	TC-SD-11	TC-SD-12	TC-SD-13	TC-SD-14	TC-SD-15
Date of Sample Collection	9/21/95	9/20/95	9/20/95	9/21/95	9/20/95	9/20/95	9/22/95	9/22/95	9/22/95	9/22/95	9/22/95	9/22/95	9/21/95	9/22/95	9/20/95
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	23,000	12,000	21,000	32,000	15,000	16,000	5,600	18,000	18,000	21,000	17	16	14	7	13
Arsenic	13	8.2	15	18	9.1J	14	8.4	19	19	17	28	25	20	42	19
Barium	34	33	28	35	17	26	--	26	26	28	3,100	7,400	10,000	5,900	11,000
Calcium	5,900	44,000	6,100	2,800	2,800	4,300	2,900	3,600	3,600	3,100	43	43	31	33	28
Chromium	43	17	40	54	30	43	12	38	38	43	--	--	--	69	6U
Copper	27	20U	20U	--	--	--	--	--	--	--	--	--	--	--	20,000
Iron	29,000	17,000	29,000	33,000	20,000	27,000	12,000	28,000	28,000	28,000	27	21	14	70	11
Lead	36	14	20	40	22	30	5.8	27	27	27	7,700	8,300	5,600	5,700	5,200
Magnesium	7,300	4,000	7,000	7,600	4,900	7,200	2,300	7,400	7,400	250	280	840	550	190	290
Manganese	550	320	370	440	190	300	110	250	250	--	0.27	--	--	0.89	0.12U
Mercury	0.36	0.08U	0.16U	--	--	--	--	--	--	--	10J	--	6.6J	12J	6.1J
Nickel	13J	6U	8.4J	18J	7.7J	10J	3.3J	10J	10J	3,300	3,700	3,600	2,200	2,300	3,000
Potassium	3,200	2,600	3,500	3,800	2,300	3,100	1,200	3,300	3,300	19,000	18,000	23,000	13,000	12,000	10,000
Sodium	16,000	7,700	18,000	16,000	13,000	18,000	3,700	19,000	19,000	64	66	62	41	55	37
Sulfur	58	32	60	87	42	57	22	64	64	73	--	--	--	180	40U
Vanadium	--	30U	70U	99	--	79	--	73	--	--	--	--	--	--	--
Zinc	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Shading indicates a value greater than or equal to background concentration.

mg/kg - Milligrams per kilogram.

-- - Indicates the sample was analyzed, but the specific analyte was not detected above the sample-specific minimum quantitation limits (SQL).

U - Sample was analyzed but analyte was not detected. The number shown is the minimum quantitation limit.

J - Estimated value.

Table 14
Summary of Inorganic Analytical Results for
Surface Water Samples
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	TC-SW-01		Background		TC-SW-02		Background		TC-SW-03		TC-SW-04		TC-SW-05		TC-SW-06		TC-SW-07		TC-SW-08		DUP		TC-SW-09		TC-SW-10		TC-SW-11		Background	
Sample Identification Number	TC-SW-01		Background		TC-SW-02		Background		TC-SW-03		TC-SW-04		TC-SW-05		TC-SW-06		TC-SW-07		TC-SW-08		DUP		TC-SW-09		TC-SW-10		TC-SW-11		Background	
Date of Sample Collection	8/21/95		9/20/95		9/20/95		9/20/95		9/20/95		9/21/95		9/20/95		9/22/95		9/22/95		9/22/95		8/22/95		9/22/95		9/22/95		9/20/95		9/20/95	
Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
Unids	340	340	360J	270J	4J	4J	20J	16J	24J	20J	13J	19J	30J	340J	560J	760J	630J	610J	610J	630J	610J	610J	610J	610J	610J	610J	610J	610J	610J	
Aluminum	19	19	20J	20J	20J	20J	20J	20J	20J	20J	13J	19J	30J	340J	560J	760J	630J	610J	610J	630J	610J	610J	610J	610J	610J	610J	610J	610J	610J	
Arsenic	10J	10J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	4J	
Barium	19	19	20J	20J	20J	20J	20J	20J	20J	20J	13J	19J	30J	340J	560J	760J	630J	610J	610J	630J	610J	610J	610J	610J	610J	610J	610J	610J	610J	
Calcium	190,000	190,000	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	210,000J	
Chromium	-	-	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	
Copper	-	-	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	30J	
Iron	440	440	410J	410J	290J	290J	490J	440J	440J	440J	24J	24J	24J	24J	24J	24J	24J	24J	24J	24J	24J	24J	24J	24J	24J	24J	24J	24J	24J	
Lead	-	-	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	10J	
Magnesium	810,000	810,000	650,000J	650,000J	650,000J	650,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	580,000J	
Manganese	170	170	200J	200J	110J	110J	390J	380J	380J	380J	150J	150J	220J	220J	190J	190J	190J	190J	190J	190J	190J	190J	190J	190J	190J	190J	190J	190J	190J	
Mercury	0.72	0.72	2.7J	2.7J	0.92J	0.92J	0.76J	0.76J	0.76J	0.76J	1.0J	1.0J	0.51J	0.51J	0.52J	0.52J	0.52J	0.52J	0.52J	0.52J	0.52J	0.52J	0.52J	0.52J	0.52J	0.52J	0.52J	0.52J	0.52J	
Potassium	180,000	180,000	190,000J	190,000J	190,000J	190,000J	170,000J	170,000J	170,000J	170,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	190,000J	
Sodium	5,100,000	5,100,000	550,000J	550,000J	5,500,000J	5,500,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	5,800,000J	5,800,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	4,900,000J	

Shading indicates a value greater than or equal to background concentration.

µg/L - Micrograms per liter.

-- Indicates the sample was analyzed, but the specific analyte was not detected above the sample-specific minimum quantitation limits (SQL).

U - Sample was analyzed but analyte was not detected. The number shown is the minimum quantitation limit.

J - Estimated value.

Table 15
Summary of Inorganic Analytical Results for
Wetland Sediment Samples
 Hercules Terry Creek Dredge Spoil Areas
 Brunswick, Glynn County, Georgia

Sample Location	Background	Offsite	Offsite	Offsite	Offsite
Sample Identification Number	TC-WSD-03	TC-WSD-01	TC-WSD-02	TC-WSD-04	TC-WSD-05
Date of Sample Collection	9/22/95	9/20/95	9/21/95	9/21/95	9/19/95
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	20,000	24,000	21,000	13,000	16,000
Arsenic	17	16	16	16	14
Barium	28	32	28	--	22
Calcium	5700J	1,900	4,000	7,100	3000J
Chromium	41	43	49	36	46
Copper	30U	--	--	--	--
Iron	32,000	32,000	31,000	28,000	28,000
Lead	22	26	24	18	21
Magnesium	7,200	5,900	7,600	7,000	6,600
Manganese	540	740	360	420	430
Mercury	0.3U	--	--	--	--
Nickel	11J	9.7J	12J	7.8J	10J
Potassium	3,500	3,200	3,400	3,000	3,400
Sodium	18,000	9,600	16,000	19,000	19,000
Vanadium	67	70	69	64	60
Zinc	800J	--	--	--	--

Shading indicates a value greater than or equal to background concentration.
 mg/kg - Milligrams per kilogram.
 -- - Indicates the sample was analyzed, but the specific analyte was not detected.
 U - Sample was analyzed but analyte was not detected. The number shown is the quantitation limit.
 J - Estimated value.

1 16 0037

7.0 Soil Exposure and Air Pathways

7.1 Physical Conditions

The Hercules Terry Creek Dredge Spoil Area Site is located near industrial, commercial, and residential areas. The site is situated offshore of a peninsula and is surrounded by coastal wetlands (Ref. 1). Area 1 is extremely overgrown and access is limited. Area 2 lies adjacent to a residential housing development and Terry Creek Trailer Park is located on Area 3. There is no fencing which limits public access to the site (Refs. 1; 5, Vol. 1, pp. 1, 1a, 8, 16, 23, and 25).

7.2 Soil Exposure and Air Pathway Targets

The estimated population within the 4-mile radius of the site is distributed as follows: 0 - 0.25 mile, 125 persons; 0.25 - 0.5 mile, 38 persons; 0.5 - 1 mile, 3,916 persons; 1 - 2 miles, 9,631 persons; 2 - 3 miles, 12,639 persons; and 3 - 4 miles, 1,192 persons (Refs. 1; 40; 41). The nearest residents are located on Area 3 of the site (Refs. 1; 5, Vol. 1, pp. 1a, 23). There are no persons working at the site and the nearest school is the Goodyear School, located 0.25 mile north of the site (Ref. 1). There are approximately 8,500 acres of wetlands located within the 4-mile radius (Refs. 1; 47).

7.3 Soil Exposure and Air Pathway Sample Locations

During the primary field investigation, grab surface soil samples were collected from onsite and from nearby residential areas. Surface soil samples TC-SS-02 and TC-SS-03 were utilized as background samples and were collected from [REDACTED] and [REDACTED] respectively, in the Back River residential area which is located east of Area 2. Surface soil sample TC-SS-01 was collected on the west side of the road leading to the Back River residential area. Two surface soil samples (TC-SS-04 and TC-SS-05) were collected from the trailer park located on Area 3. Soil sample locations are shown on Figure 4 and are described in Table 2. Surface soil samples which were collected as source samples from Areas 1 and 2 are described in Section 4.2. Soil sample locations are illustrated on Figures 3, 4, and 5.

In response to analytical results from the primary field investigation, the addendum field investigation was conducted to determine if widespread soil contamination was present in the site vicinity. A total of 22 composite surface soil samples, 2 grab surface soil samples and 10 grab subsurface soil samples were collected from the trailer park located on and around Area 3, from the Crandall Street/Riverside Drive neighborhood located northwest of Area 1, from the Riverside Drive neighborhood

located adjacent to Area 2, from the nursing home and vacant property located west of Area 1, and from the Goodyear School and the Burroughs-Molette Elementary School. Community sample locations are presented on Figures 6, 7, and 8. Surface soil sample TC-CS-SS-22 was used as a background sample for the addendum sampling.

No formal air sampling program was conducted. Portable flame ionization detectors, or organic vapor analyzers (OVAs) were used for onsite safety monitoring during sampling activities. No readings were noted above background levels while performing air monitoring during the collection of soil samples.

7.4 Soil Exposure Analytical Results

During the primary field investigation, toxaphene was detected in surface and subsurface soil samples collected from Areas 1, 2, and 3 as described in section 4.3.1 of this report. In addition, toxaphene was detected at elevated levels in surface and subsurface soil samples collected from residential areas in the site vicinity. Other organic and inorganic analytes were detected at elevated levels in soil samples. The analytical results are summarized in Tables 4, 6, 16, 17, 18, and 19. Sample locations are illustrated on Figures 4, 5, 6, 7, and 8.

7.4.1 Surface Soil Organic Analytical Results

Analytical results from surface soil sample TC-SS-01, located adjacent to Riverside Drive, north of Area 1, revealed an elevated concentration of toxaphene at 37,000 $\mu\text{g/kg}$ (54,000 $\mu\text{g/kg}$). Surface soil samples collected from the trailer park located on Area 3 (and within 200 feet of residences) (TC-SS-04, TC-SS-05) also revealed elevated levels of toxaphene. Surface soil sample TC-SS-04 contained toxaphene at 680 $\mu\text{g/kg}$ (2,200 $\mu\text{g/kg}$), and surface soil sample TC-SS-05 contained toxaphene at 2,200 $\mu\text{g/kg}$ (9,300 $\mu\text{g/kg}$). In addition to toxaphene, aldrin, dieldrin, 4,4'-DDE, 4,4'-DDT, methoxychlor, gamma-chlordane, and alpha-chlordane were detected in sample TC-SS-05. Additionally, toluene was detected in samples TC-SS-06 and TC-SS-08, both located in Area 1, and dimethyl phthalate was detected in sample TC-SS-16 located north of Area 1. Surface soil organic analytical results for the primary field investigation are presented in Table 4.

One surface soil sample and one subsurface soil sample collected during the addendum investigation contained elevated levels of toxaphene. No addendum samples were analyzed for toxaphene using the method prescribed by the EPA

Table 16
Summary of Organic Analytical Results
Surface Soils/Community Samples
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	Background	TC-MB-53-01	TC-CS-53-01	TC-CS-53-01	TC-CS-53-03	TC-CS-53-04	TC-CS-53-06	TC-CS-53-04	TC-CS-53-07	TC-CS-53-08	TC-CS-53-10	TC-CS-53-11	TC-CS-53-12	TC-CS-53-13
Date of Sample Collection	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96
Purgeable Organics	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Carbon Dioxide	2J	..	..	..	..	..	..	..	..	..	..	..	..	..
Chloroform	11U	..	..	..	..	..	..	..	..	..	..	..	..	..
Toluene	11U	..	..	..	..	..	..	..	..	..	..	..	..	..
Misc. Purgeable Organics	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Camphene	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pinene	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Unidentified Compound(s)	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Extractable Organics	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Naphthalene	720U	..	280J	..	..	..	..	..	..	..	..	..	..	..
2,4,6-Trichlorophenol	720U	..	..	..	..	..	..	..	..	..	..	..	..	..
2-Methylnaphthalene	720U	..	140J	..	..	..	..	..	..	..	..	..	..	..
Acenaphthylene	720U	..	90J	..	..	..	..	..	..	..	..	..	..	..
Acenaphthene	720U	..	120J	..	..	..	..	..	..	..	..	..	..	..
Dibenzofuran	720U	..	190J	..	..	..	..	..	..	..	..	..	..	..
Dibenzofluorene	720U	..	..	..	..	..	..	..	..	..	..	..	..	..
Fluorene	720U	..	160J	..	..	..	..	..	..	..	..	..	..	..
Phenanthrene	720U	..	2,000	..	..	..	..	..	..	..	..	..	..	..
Anthracene	720U	..	200J	..	..	..	..	..	..	..	..	..	..	..
Carbazole	720U	..	370J	..	..	..	..	..	..	..	..	..	..	..
Fluoranthene	720U	..	2,300	..	..	..	..	..	..	..	..	..	..	..
Pyrene	120U*	..	2,300	..	..	..	..	..	..	..	..	..	..	..
Benzo(a)anthracene	720U	..	1,100	..	..	..	..	..	..	..	..	..	..	..
Chrysene	87J*	..	1,200	..	..	..	..	..	..	..	..	..	..	..
Benzo(b)fluoranthene	720U	..	..	..	..	..	..	..	..	..	..	..	..	..
Benzo(k)fluoranthene	120U*	..	2,300J	..	..	..	..	..	..	..	..	..	..	..
Benzo(a)pyrene	720U	..	1,100	..	..	..	..	..	..	..	..	..	..	..
Indeno(1,2,3-cd)pyrene	720U	..	890J	..	..	..	..	..	..	..	..	..	..	..
Benzo(ghi)perylene	720U	..	790	..	..	..	..	..	..	..	..	..	..	..
Perylene	720U	..	..	..	..	..	..	..	..	..	..	..	..	..
Dibenz(a,h)anthracene	3.6U	..	..	..	..	..	..	..	..	..	..	..	..	..
Benzo(a)pyrene	1.8U	..	..	..	..	..	..	..	..	..	..	..	..	..
Heptachlor epoxide	1.8U	..	..	..	..	..	..	..	..	..	..	..	..	..
4,4'-DDE	3.6U	..	..	..	..	..	..	..	..	..	..	..	..	..
Gamma-Chlordane / 2	1.8U	..	..	..	..	..	..	..	..	..	..	..	..	..
Alpha-Chlordane / 2	1.8U	..	..	..	..	..	..	..	..	..	..	..	..	..
Teaflavone	270U	..	..	..	..	..	..	..	..	..	..	..	..	..

Shading indicates a value of three times background or above.
µg/g - Micrograms per kilogram.

.. - Indicates the material was analyzed but not detected above the sample-specific minimum quantization limit (SQL).
C - Confirmed by GC/MS
J - Estimated value.

N - Presumptive evidence of presence of material

U - Material was analyzed but not detected. The number shown is the minimum quantization limit.

* - Estimated value is below the SQL.

Table 16 *Continued*

Brunswick, Glynn County, Georgia													
Sample Location	Background	TC-SS-14	TC-SS-15	TC-SS-16	TC-SS-17	TC-CS-33-18	TC-CS-SS-20	TC-CS-SS-21	DUP	TC-CS-SS-23	TC-CS-SS-24	TC-RS-SS-D1	TC-RS-SS-O2
Sample Identification Number	TC-CB-SS-22	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96
Date of Sample Collection	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g
Purgeable Organics	2J	--	--	--	--	2J*	--	--	--	--	--	--	--
Carbon Dioxide	11UJ	--	--	--	4J*	--	--	18J	68J	--	--	2J	3J*
Chloroform	11UJ	--	--	--	40JIN	--	--	--	--	--	--	μg/g	μg/g
Toluene	μg/g	μg/g	μg/g	μg/g	800JIN	--	--	--	--	--	--	μg/g	μg/g
Misc. Purgeable Organics	μg/g	μg/g	μg/g	μg/g	60J/2	--	--	20J/1	30J/1	--	--	μg/g	μg/g
Camphene	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g
Phenane	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g
Unidentified Compound(s)	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g
Extractable Organics	720U	1,400J*	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	720U	--	--	--	48J*	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	720U	870J*	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	720U	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	720U	3,700J*	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	720U	2,000J*	--	--	--	--	--	--	--	--	--	--	--
Fluorene	720U	3,400J*	--	--	--	--	--	--	--	--	--	--	--
Pyrene	720U	22,000	--	--	--	--	--	--	--	--	--	--	--
Benzofluoranthene	720U	8,400	88J	78J	--	60J*	--	99J*	79J*	81J*	840J*	--	--
Benzo(a)pyrene	720U	22,000	--	74J	--	48J*	--	--	--	84J*	--	--	--
Benzo(b)fluoranthene	720U	14,000	--	81J	--	--	--	--	--	48J*	--	--	--
Chrysene	720U	12,000	--	--	--	--	--	--	--	--	--	--	--
Benzo(ghi)perylene	720U	12,000	--	73J	--	--	--	--	130J*	--	300J*	--	--
Benzo(a)anthracene	720U	15,000	--	--	--	--	--	--	--	--	880J*	--	--
Benzo(e)pyrene	720U	8,400	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	720U	8,400	--	--	--	--	--	--	--	--	--	--	--
Benzo(ghi)perylene	720U	8,400	--	--	--	--	--	--	--	--	--	--	--
Perfluorinated PCBs	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g	μg/g
Heptachlor	1.8U	--	--	--	--	--	--	27	84	--	--	--	--
Heptachlor epoxide	1.8U	--	--	--	--	7.7	340	210	--	--	--	--	--
4,4' DDE	3.8U	--	5.4	--	--	8.4	--	--	--	--	--	--	--
Gammachlorodioxin /2	1.8U	--	--	--	--	18	270	240	--	--	--	--	--
Alpha-Chlorodioxin /2	1.8U	--	--	--	--	26	160	120	--	--	--	--	--
Toxaphene	270U	--	--	--	--	1,100	--	--	--	--	--	--	--

Students indicated a value of three times background or above.

units - Micrograms per liter.

μg/g - Micrograms per kilogram.

10 - Indicates the number of

2. Comparison of the

24. Quantitative evidence of occurrence of material

11. Sampled was analyzed but not detected. The number shown is the minimum quantitation limit.

- Estimated volume in history SOL

Summary of Organic Analytical Results
Subsurface Soil/Community Samples
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	TC-CS-SB-01	TC-CS-SB-02	TC-CS-SB-03	TC-CS-SB-16	TC-CS-SB-17	TC-CS-SB-18	TC-MB-SB-01	TC-RS-SB-01	TC-RS-SB-02	Background
Date of Sample Collection	2/28/96	2/28/96	2/28/96	2/29/96	2/29/96	2/29/96	2/28/96	2/28/96	2/28/96	TC-CS-SB-22
Extractable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
[3-and/or 4-Methylphenol]	-	-	1100J*	-	-	-	-	-	-	390U
Benzol and/or 2-fluoranthene	-	-	-	-	-	-	-	-	-	390U
Naphthalene	-	-	1300J*	-	-	-	-	-	-	390U
Phenanthrene	-	-	770J	-	-	-	-	-	-	390U
Miscellaneous Extractable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Alkanes	800J	-	2,000J	-	-	-	-	-	2,000J	µg/kg
Carophyllene	-	-	-	-	-	-	700JN	-	-	-
Cinnamyl Cinnamate	-	-	-	-	-	-	300JN	-	-	-
Methyl(methyl)phenanthrene	400JN	400,000JN	-	-	-	-	-	-	-	-
Octahydrodimethyl(methyl)ethyl-phenanthrene carboxylic acid-methylester	400JN	-	9,000JN	-	-	-	-	-	-	-
Tetramethylphenanthrene	-	-	60,000JN	-	-	700JN	-	-	-	-
Trimethylphenanthrene	-	-	10,000JN	-	-	-	-	-	-	-
Unidentified Compound/#	10,000J/14	700,000J/7	500,000J/24	-	-	6,000J/7	-	-	500J/1	-
Pesticides/PCBs	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Dieldrin	-	32	-	-	-	-	-	-	-	3.9U
4,4'-DDE	-	-	-	-	-	4.9	-	-	-	3.9U
Alpha-Chlordane/2	-	2.7J	-	-	-	-	-	-	-	-
Toxaphene	1,900	-	-	-	-	-	-	-	-	200U
Purgeable Organics	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Acetone	-	-	120J	-	-	-	-	-	-	400U
Methyl Ethyl Ketone	-	-	-	-	4J	-	-	-	-	3U
Toluene	-	-	-	-	-	-	-	-	-	12U
Camphene	-	-	6J	-	-	-	-	-	-	-
Pinene	-	-	-	-	-	30JN	-	-	-	-
Trimethylcycloheptene	-	900JN	4,000JN	-	-	100JN	-	-	-	-
Unidentified Compound/#	200J/1	200J/1	300J/1	-	-	-	-	-	-	-

Shading Indicates a value of three times background or above detection background detection limit if not detected.

µg/kg - Microgramme per kilogram.

- - - Indicates the material was analyzed for but not detected above the sample-specific minimum quantitation limits (SQL).

J - Estimated value.

* - Estimated value is below the SQL.

N - Presumptive evidence of presence of material

U - Material was analyzed for but not detected. The number shown is the minimum quantitation limit.

... - Toxaphene analyses performed by EPA - ESD per method determined by EPA Toxaphene Task Force June 4, 1983.

Table 18
Summary of Inorganic Analytical Results
Surface Soil/Community Samples
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	Background	TC-MB-SS-01	TC-CS-SS-01	TC-CS-SS-03	TC-CS-SS-04	TC-CS-SS-06	TC-CS-SS-08	TC-CS-SS-07	TC-CS-SS-08	TC-CS-SS-10	TC-CS-SS-11	TC-CS-SS-12	TC-CS-SS-13
Sample Identification Number	TC-CS-SS-22	TC-MB-SS-01	TC-CS-SS-01	TC-CS-SS-03	TC-CS-SS-04	TC-CS-SS-06	TC-CS-SS-08	TC-CS-SS-07	TC-CS-SS-08	TC-CS-SS-10	TC-CS-SS-11	TC-CS-SS-12	TC-CS-SS-13
Date of Sample Collection	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	2,800	3,300	3,300	2,400	2,200	3,000	1,400	1,200	1,200	2,100	1,800	1,700	1,400
Arsenic	5.6	--	--	1.8J	1.3	--	1.8J	--	--	--	--	--	9.2
Berkium	8.2	13	11	21	26	12	14	12	11	6.7	42	12	12
Beryllium	0.02U	--	0.16J	--	--	0.17J	--	--	--	--	--	--	--
Cadmium	0.23U	--	--	--	--	--	1.1	--	--	--	--	--	--
Calcium	860U	--	1,900J	18,000J	3,600J	1,500J	2,300J	2,400J	2,000J	1,800J	3,900J	1,000J	2,800J
Chromium	4J	3.6J	3.8J	5.3J	5.6J	3.8J	2.4J	2.3J	2.5J	4J	3.9J	2.9J	40J
Cobalt	0.60U	--	--	--	--	--	0.96J	--	--	--	--	--	2.4J
Copper	6.2	4J	26J	20J	23J	11J	8J	17J	11J	10J	18J	22J	84J
Cyanide	0.11U	--	--	--	--	--	--	--	--	--	0.87	--	--
Iron	1,000	1,100J	860J	2,100J	2,200J	1,000J	1,700J	1,100J	1,200J	1,300J	2,900J	1,200J	16,000J
Lead	34	17	10	23	49	14	24	24	27	11	37	15	97
Magnesium	130U	70	240	880	480	200	480	600	360	280	470	280	280
Manganese	11	10J	16J	72J	58J	12J	58J	30J	43J	25J	90J	34J	87J
Nickel	0.1U	--	--	3.3J	2.8J	--	2.9J	3J	2.3J	--	2.8J	--	83
Potassium	52J	74	120	13,000	280	140	160J	100	100	70	200	48J	110
Sodium	30U	--	--	400	--	--	--	--	--	--	--	--	--
Vanadium	4.5J	3.4J	3J	7.6J	5.8J	6.7J	6J	4.1J	6.2J	3.6J	5.6J	3.6J	4.6J
Zinc	20	30	22	68	65	21	67	37	36	28	74	68	98

Shading indicates a value greater than or equal to background concentration.

mg/kg - Milligrams per kilogram.

-- Indicates the sample was analyzed, but the specific analyte was not detected above the sample-specific minimum quantitation limits (SOL).

U - Material was analyzed for but not detected. The number shown is the minimum quantitation limit.

J - Estimated value.

Table 18 Continued
Summary of Inorganic Analytical Results
Surface Soil/Community Samples
 Hercules Terry Creek Dredge Spoil Areas
 Brunswick, Glynn County, Georgia

Sample Location	Background	TC-CS-SS-14	TC-CS-SS-15	TC-CS-SS-16	TC-CS-SS-17	TC-CS-SS-18	YS-CS-SS-20	TC-CS-SS-21	TC-CS-SS-41	TC-CS-SS-23	TC-CS-SS-24	TC-RS-SS-01	TC-RS-SS-02
Date of Sample Collection	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	2,600	9,000	1,700	1,900	1,000	950	4,800	3,300	3,300	3,300	2,800	3,700	1,800
Arsenic	5.6	1.4J	--	--	--	--	--	--	--	--	3.8J	2.8	--
Barium	8.2	56	8.9	19	11	7.9	67	47	44	14	28	9.1	6.5
Beryllium	0.02U	1.3	0.18J	--	--	--	0.58J	0.18J	0.18J	--	0.18J	--	--
Cadmium	0.23U	--	--	--	--	--	--	--	--	--	--	--	0.22
Calcium	540U	38,000J	3,700J	4,000	2,900	1,000	9,300	8,400	6,900	2,400	13,000	--	--
Chromium	4J	3.7J	2.7J	3.7	2.5	2.2	7.2	7	7.2	6.4	13	150J	2.3
Cobalt	0.60U	--	--	--	--	--	--	--	--	--	--	--	--
Copper	6.2	25J	31J	12	4.2J	7.1	21	22	23	7.5	--	15J	8.1
Cyanide	0.11U	--	--	--	--	--	--	--	--	--	17	--	--
Iron	1,000	1,900J	1,300J	1,900	1,100	890	2,400	3,000	3,000	1,400	4,200	12,000J	230
Lead	34	21	22	43	9	6.9	89	26	26	8.2	17	13	0.85
Magnesium	120U	2,800J	1,700	290	290	--	3,900	530	570	390	810	140	--
Manganese	11	170J	36J	48	43	37	280	100	100	17	53	86J	3
Nickel	0.1U	2.8J	2.1J	--	1.7J	--	--	4.8J	4.4J	--	4.8J	5.2J	--
Potassium	92J	1,500	71J	180	70J	--	730	190	180	150J	300	91J	--
Sodium	30U	360	--	--	360	--	320	--	--	--	--	--	--
Vanadium	4.5J	8.6J	3.7J	5.9J	2.7J	3.2J	11J	9.6J	9.6J	4.8J	11	4.7J	1.6J
Zinc	20	60	25	61	77	--	91	71	72	23	120	17	--

Shading indicates a value greater than or equal to background concentration.
 mg/kg - Milligrams per kilogram.

-- Indicates the sample was analyzed, but the specific analyte was not detected above the sample-specific minimum quantitation limits (SQL).

U - Material was analyzed for but not detected. The number shown is the minimum quantitation limit.

J - Estimated value.

Table 19
Summary of Inorganic Analytical Results
Subsurface Soil/Community Samples
Hercules Terry Creek Dredge Spoil Areas
Brunswick, Glynn County, Georgia

Sample Location	TC-CS-SB-01	TC-CS-SB-02	TC-CS-SB-03	TC-CS-SB-16	TC-CS-SB-17	TC-CS-SB-18	TC-MB-SB-01	TC-RS-SB-01	TC-RS-SB-02	Background
Sample Identification Number	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/28/96	2/29/96
Date of Sample Collection	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Units	1,400	1,800	1,600	500	600	2,700	5,800	8,700	2,400	2,700
Aluminum	--	--	--	--	--	--	--	4.4J	--	0.62U
Arsenic	--	9.4	8.2	1.3	1.5	6.3	7.6	26	2.3	2.3
Barium	--	--	--	--	--	0.18J	0.17J	1.3J	--	0.02U
Beryllium	2400J	1100J	1400J	--	--	1,300	--	3,500J	790	40U
Calcium	--	2.9J	2.9J	--	--	4.6J	3.7J	18J	3.2	2.7J
Chromium	16J	16J	19J	--	--	--	22J	7.3J	6.1	2.7J
Copper	600J	880J	910J	140	360	1,800	350J	11,000J	170	320
Iron	4.5	4.9	5.3	1.4	1.4	20	7.6	8.5	2.2	2.6
Lead	210	240	260	58	190	660	110	1,500	--	80U
Magnesium	8.2J	12J	14J	6.3	2.8J	11	4.6J	54J	3.5	2.6J
Manganese	--	--	--	0.21	--	--	--	--	--	0.06U
Mercury	--	--	--	--	--	--	2.3J	5.8J	--	0.83U
Nickel	--	--	--	--	--	--	58	1,000	--	40U
Potassium	--	88J	88	--	95J	270	--	--	--	30U
Sodium	--	450	--	--	820	630	--	--	--	1.9J
Vanadium	3.3J	2.7J	2.6J	--	--	--	--	22	--	6U
Zinc	--	14	--	--	--	--	--	26	--	--

Shading indicates a value greater than or equal to background concentration.

mg/kg - Milligrams per kilogram.

-- - Indicates the sample was analyzed, but the specific analyte was not detected above the sample-specific minimum quantitation limits (SQL).

J - Material was analyzed for but not detected. The number shown is the minimum quantitation limit.

U - Estimated value.

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Toxaphene Task Force. One surface soil composite sample collected adjacent to Riverside Drive (TC-CS-SS-18) contained toxaphene at 1,100 µg/kg. One subsurface soil sample collected from the trailer park located at Area 3 also contained toxaphene at a concentration of 1,900 µg/kg; however, subsurface soil samples are typically not considered part of the soil exposure pathway because of the depth at which they are collected. Numerous extractable organic compounds were detected in TC-CS-SS-01, located in Area 3, and TC-CS-SS-14, located in Area 3, at elevated concentrations ranging from 790 µg/kg to 28,000 µg/kg. Bis(2-ethylhexyl) phthalate was detected in TC-CS-SS-10, located at the trailer park, at 8,900 µg/kg. Chloroform was detected in surface soil sample TC-CS-SS-20 located southeast of Crandall Street at an estimated concentration of 19 µg/kg. Toluene was detected at an estimated elevated concentration of 36 µg/kg in surface soil sample TC-CS-SS-08 located at Area 3. Numerous pesticides including, dieldrin, heptachlor, heptachlor epoxide, 4,4'-DDE, gamma-chlordane, and alpha-chlordane were detected at elevated concentrations ranging from 4.6 µg/kg to 270 µg/kg in surface soil samples. Surface soil analytical results for the primary field effort are presented in Table 4. Summaries of surface and subsurface soil sample organic analytical results for the addendum sampling event are presented in Tables 16 and 17.

7.4.2 Surface Soil Inorganic Analytical Results

Numerous inorganic analytes, including aluminum, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, cyanide, iron, magnesium, manganese, nickel, potassium, sodium, silver, vanadium, and zinc were detected at elevated levels ranging from 0.11 mg/kg to an estimated 35,000 mg/kg in surface soil samples collected for the Hercules Terry Creek Dredge Spoil Area site. Surface soil inorganic analytical results are presented in Table 6. Surface and subsurface soil sample analytical results for the addendum sampling event are presented in Tables 18 and 19.

7.5 Soil and Air Conclusions

Surface soil samples collected at the site and in surrounding residential areas have indicated elevated levels of toxaphene. The soil pathway is a pathway of concern due to Terry Creek Trailer Park's location on Area 3 and the residential housing development located adjacent to Area 2. Airborne contamination is of limited concern at this site due to the proximity of residences to a source, the low volatility of toxaphene, the vegetative cover throughout most of the dredge spoil areas, and the lack of workers on site.

8.0 Summary and Conclusions

The ESI for the Hercules Terry Creek Dredge Spoil Area was performed to gather information necessary to evaluate the site for further action under CERCLA and SARA. A total of 54 environmental samples were collected during the field investigation conducted during the week of September 19, 1995 and a total of 29 environmental samples were collected during the field investigation conducted during the week of February 28, 1996, to characterize the nature of contamination at the site and to determine if contamination, if present, has migrated from the site. Information obtained for this ESI confirms much of the information that has been provided about the site through numerous other past investigations. Analytical results from the environmental samples indicate that surface soil, subsurface soil, sediment at the site, and sediment in wetlands near the site have been impacted by releases of toxaphene caused by disposal activities at the Hercules Terry Creek Dredge Spoil Area.

Contamination was not detected in any of the potable supply wells sampled. Although inorganic constituents were detected in groundwater samples; they are not believed attributable to contaminated sediments deposited at the Hercules Terry Creek Dredge Spoil Area. Due to the lack of actual contamination in a potable well and a relatively low target population, the groundwater pathway is not a pathway of primary concern for this site.

Analytical results of sediment samples collected from Dupree and Terry creeks, the confluence of Dupree and Terry creeks, the Hercules, Inc., NPDES outfall drainage ditch, and the Back River indicated elevated levels of toxaphene. Toxaphene has also been detected in soil samples collected from the site areas. Dupree and Terry Creeks and the Back River are known fisheries and habitats for several federally-endangered species. The surface water migration pathway is a pathway of primary concern for the site.

Surface soil samples collected at the site and in surrounding residential areas have indicated elevated levels of toxaphene. The soil pathway is a pathway of concern due to proximity of residential housing to areas of contamination. Airborne contamination is of limited concern at this site due to the proximity of residences to a source. The air migration pathway is limited by the low volatility of toxaphene, vegetative cover throughout the site areas, and the lack of workers on site.

9.0 References

1. U.S. Geological Survey, 7.5 minute series, Topographic Quadrangle Maps of Georgia: Brunswick West 1979 (Photorevised [PR] 1988), Dover Bluff 1979 (PR 1988), Jekyll Island 1979, Brunswick East 1979 (PR 1988), Sea Island 1979 (PR 1985), scale 1:24,000.
2. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Camden and Glynn Counties, Georgia, (November 1980).
3. U.S. Department of Commerce, Climatic Atlas of the United States, (Washington, D.C.: GPO, June 1968) Reprint: 1983, National Oceanic and Atmospheric Administration.
4. U.S. Department of Commerce, Rainfall Frequency Atlas of the United States, Technical Paper N° 40 (Washington, D.C.: GPO, 1961).
5. Black & Veatch, Field Logbook for Hercules Terry Creek Dredge Spoil Area Sampling Trip, Brunswick, Glynn County, Georgia, Volume 1, September 19 - 26, 1995, and February 28 - 29, 1996, and Volume 2, September 19 - 22, 1995, and February 28 - 29, 1996.
6. Philip R. Parsley, Chief, Technical Support Branch, Department of the Army, Savannah District Corps of Engineers, letter to Kristen Lombard, Black and Veatch Waste Science, March 27, 1996. Subject: USACE records concerning Hercules Terry Creek Dredge Spoil Area.
7. Richard A. Hill, Chief, Economic and Social Analysis Branch, Disposition Form, February 29, 1988. Subject: Maintenance of Terry Creek, Brunswick Harbor.
8. H.T. DeRigo, Department of the Army, Savannah District Corps of Engineers, Internal Departmental Memorandum forwarded to Mario Villamarzo, EPA, June 16, 1971. Subject: Toxaphene Discharge from Hercules and Toxalogical Action.

9. Charles W. Belin, Department of the Army, Savannah District Corps of Engineers, Memorandum to Deputy District Engineer, March 7, 1986. Subject: Dredging of toxaphene-contaminated sediments at Terry Creek, Brunswick, Georgia.
10. Charles W. Belin, Department of the Army, Savannah District Corps of Engineers, Memorandum to File, February 12, 1987. Subject: History of Terry Creek Dredge Spoil Area.
11. Elizabeth King, Department of the Army, Savannah District Corps of Engineers, Memo to Terry Tanner, NUS Corporation, February 2, 1990. Subject: Dredging History of Terry Creek.
12. Georgia DNR, EPD, NPDES Permits from November 5, 1976, until Present, Issued to Hercules, Inc., Brunswick, Georgia.
13. Georgia DNR, EPD, Computer Database Printout of NPDES Violations from July 1988 to July 1993.
14. ATEC Associates, Inc., "Best Management Practices Plan for Hercules Incorporated", Brunswick, Georgia, May 7, 1993.
15. Robert Reimold and Charles Durant, "Survey of Toxaphene Levels in Georgia Estuaries," Georgia Marine Science Center, Skidaway Island, Georgia. Technical Report Series N^o. 72-2.
16. Robert Reimold and Charles Durant, "Monitoring Toxaphene Contamination in a Georgia Estuary," Georgia Marine Science Center, Skidaway Island, Georgia. Technical Report Series N^o. 72-8.
17. Department of the Army, South Atlantic Division Laboratory, Savannah District Corps of Engineers, Drilling Log and Sample Location Map for Terry Creek Dredge Spoil Area, January 23, 1985.
18. Savannah Labs and Environmental Services, Inc., "The Status of Toxaphene Contamination in Terry Creek at Brunswick, Georgia," February 4, 1986.

19. Georgia DNR, EPD, "Screening Site Inspection Report, Terry Creek Dredge Spoil Area, GAD982112658," prepared by John O. Costello, September 1987.
20. Anna Torgrimson, EPA, telephone conversation with Terry Tanner, NUS Corporation, January 11, 1991. Subject: Hercules 009 Landfill.
21. Glynn Hoffman, Hercules Incorporated, telephone conversation with Terry Tanner, NUS Corporation, January 17, 1991. Subject: Hercules 009 Landfill.
22. John A. McKeown, South Superfund Remedial Branch, WMD, memorandum to file, May 8, 1996. Subject: Surface water pathway concerns for Terry Creek Dredge Spoil Site.
23. Phillip H. Howard, ed., 1991, Handbook of Environmental Fate and Exposure Data, v. 3, Pesticides (Chelsea, Michigan: Lewis Publishers).
24. Susan Budavari, ed., 1989, The Merck Index, 11th ed., Rahway, N.J.: Merck & Co., Inc.
25. BLACK & VEATCH Waste Science, Inc., Final Field Study Plan, Expanded Site Inspection, Terry Creek Dredge Spoil Area, Brunswick, Glynn County, Georgia, September 5, 1995.
26. Black & Veatch Special Projects Corp., Addendum to Field Study Plan, Expanded Site Inspection, Terry Creek Dredge Spoil Area, Brunswick, Glynn County, Georgia, February 21, 1996.
27. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses
28. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses, TDD HQ-8410-01, May 28, 1985.
29. Kristen V. Lombard, Black and Veatch, telephone conversation with Gary Bennett, EPA ESD, February 2, 1996. Subject: Data qualification.

- 1 10 0072
30. Department of the Army, Savannah District Corps of Engineers, Second Generation Dike Construction Plans, May 16, 1986.
 31. EPA, "Site Analysis Terry Creek Dredge Spoil Area, Brunswick, Georgia," May 1991.
 32. Richard E. Krause and Robert B. Randolph, Hydrology of the Floridan Aquifer System in Southeast Georgia and Adjacent Parts of Florida and South Carolina, U.S. Geological Survey Professional Paper 1403-D, Washington, D.C. GPO, 1989.
 33. D.O. Gregg and E.A. Zimmerman, Geologic and Hydrologic Control of Chloride Contamination in Aquifers at Brunswick, Glynn County, Georgia, U.S. Geological Survey Water Supply Paper 2029-D, Washington, D.C.: GPO, 1974.
 34. R.L. Wait, Geology and Occurrence of Fresh and Brackish Ground Water in Glynn County, Georgia, U.S. Geological Survey Water Supply Paper 1613-E, Washington, D.C.: GPO, 1965.
 35. Stephen M. Herrick, A Subsurface Study of Pleistocene Deposits in Coastal Georgia, U.S. Geological Survey Information Circular 31, 1965.
 36. Joe Riley, Owner, South Georgia Well and Pump, telephone conversation with Carter Helm, BVWS, December 2, 1993. Subject: Shallow aquifer characteristics in Brunswick, Georgia.
 37. Woodrow Sapp, Owner, Woodrow Sapp and Sons Water Well Drilling, telephone conversation with Carter Helm, BVWS, December 6, 1993. Subject: Shallow aquifer use in Brunswick, Georgia.
 38. William Francis, Assistant Director, Brunswick Water Department, telephone conversation with Carter Helm, BVWS, December 6, 1993. Subject: Private well areas in Brunswick, Georgia.

39. IT Corporation, "Remedial Investigation Report, 009 Landfill, Hercules Incorporated, Brunswick, Glynn County, Georgia," prepared for Hercules Incorporated, Hercules Plaza, Wilmington, Delaware, Project N^o. 595492 August, 1990.
40. Bill Powell, Assistant Director, Brunswick Water Department, telephone conversation with Kristen V. Lombard, Black and Veatch Waste Science, Inc., and attachment, April 12, 1995.
41. U.S. Department of Commerce, Bureau of the Census, 1990 Census of Population and Housing: Summary Population and Housing Characteristics-Florida, 1990 CPH-1-11 Washington, D.C.: GPO, 1991.
42. EPA, Graphical Exposure Modeling System (GEMS) Data Base, compiled from U.S. Bureau of the Census data, 1980.
43. Philip Laumeyer, Assistant Field Supervisor, United States Department of the Interior, Fish and Wildlife Service, letter to colonel Stanley G. Genega, District Engineer, U.S. Army Corps of Engineers, February 4, 1987. Subject: Ecological Assessment of Terry Creek.
44. Federal Emergency Management Agency (FEMA), National Flood Insurance Program, Flood Insurance Rate Map, Community Panel Number 11 of 25, City of Brunswick, Georgia, January 28, 1987.
45. James Music, Georgia Department of Natural Resources (coastal), telephone conversation with Kristen V. Lombard, March 8, 1996. Subject: Fishery status of Brunswick, Georgia surface water bodies.
46. Harry E. Hottell, Daniel R. Holder, and C.E. Coomer, Jr., 1983, A Fisheries Survey of the Altamaha River, Georgia DNR, Game and Fish Division.
47. Mike Harris, Wildlife Biologist, Georgia Department of Natural Resources (Coastal), telephone conversation with Kristen V. Lombard, Black and Veatch Special Projects Corporation, March 8, 1996. Subject: Endangered and/or threatened species located in Brunswick, Georgia.

48. Federal Endangered, Threatened, and Proposed Species listed in Glynn County, Georgia.
49. U.S. Department of the Interior, Fish and Wildlife Service, National Wetlands Inventory, Brunswick West, Georgia (1990), scale 1:24,000.



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US EPA -- Region IV
Expanded Site Inspection
Work Assignment No. 14

BVSPC Project 52014.750
January 15, 1997
BRANCH

Mr. Curtis Fehn
Chief, South Site Management Branch
U. S. Environmental Protection Agency, Region IV
The Federal Center, 9th Floor Mailroom
100 Alabama Street, SW
Atlanta, Georgia 30303

Subject: Final Expanded Site Inspection
Report
Hercules Terry Creek Dredge Spoil
Area
Brunswick, Glynn County,
Georgia
EPA ID No.: GAD982112658
WasteLAN No.: 04439

Dear Mr. Fehn:

Enclosed please find enclosed two copies of the Final Expanded Site Inspection Report for the Hercules Terry Creek Dredge Spoil Area site located in Brunswick, Glynn County, Georgia. All Draft Expanded Site Inspection Report comments from John McKeown, EPA SAM, have been incorporated into the Final Report.

If you have any questions, please contact me at (770)643-2306.

Sincerely,

Black & Veatch Special Projects
Corp.

Carter J. Helm
Project Manager

cjh
Enclosures

cc: Doug Thompson, EPA PO, w/o enclosures
Deborah Davidson, EPA CO, w/o enclosures
Dorothy Rayfield, EPA WAM, w/o enclosures
John McKeown, EPA SAM, w/o enclosures

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